THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXXII. No. 815.] LONDON, DECEMBER 24, 1878. [30th Year.] Price 6d.

COOKE BROS.

See Page 938.

26, 27, & 28, FENCHURCH ST.,

LONDON, E.C.

GENUINE TORBAY PAINT

And SPECIAL GASOMETER PAINT.

Several Prize Medals. Established over 20 Years.

These Paints are now used in over 200 Country Gas-Works, and by all the London Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.

The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov. 2, 1866.*

Supplied, mixed ready for use, or in paste, as desired.

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BROOKFIELD GAS APPARATUS WORKS,

103, ICKNIELD STREET EAST, BIRMINGHAM.

CONTRACTOR FOR

LAYING MAINS

FOR

Gas, Water, & Sanitary Purposes,

AND MANUFACTURER OF

WOOD GRIDS

FOR

SCRUBBERS AND PURIFIERS.

COWEN'S PATENT FIRE-CLAY RETORTS.

JOSEPH COWEN and CO.,

BLAYDON BURN, BLAYDON-ON-TYNE,

Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."

J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.

COWEN'S GARESFIELD COALS.

Jos. Cowen & Co. are the only Manufacturers of Fire-Bricks and Clay Retorts at Blaydon Burn.

JOHN RUSSELL & CO.,

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Established at the commencement of Gas Lighting,

Manufacturers of

TUBES AND FITTINGS.

THREE PRIZE MEDALS,

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ALMA TUBE-WORKS, WALSALL;

OLD PATENT TUBE-WORKS, WEDNESBURY.

JOHN BENT & SON,

BELL BARN ROAD, BIRMINGHAM,

Manufacturers of

WET AND DRY GAS-METERS,

Licensees and Manufacturers of

HUNT'S

PATENT COMPENSATING METERS,

STREET-LAMPS, &c., &c.

Established 1830.

THOMAS PIGGOTT & CO.,

SPRING HILL, BIRMINGHAM,

Manufacturers of

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO,

And Gas Apparatus of every description.

Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.

Sugar, Saltpetre, and all kinds of Pans.

Roofs, Girders, and Bridges, and General Smith's Work.

J. & H. ROBUS,

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RETORT-SETTING A SPÉCIALITÉ.

ROBUS'S IMPROVED RETORT-SETTINGS guaranteed to carbonise a large amount of coal with a small per cent. of fuel.

N.B.—All kinds of Fire Goods, &c., kept in stock for immediate delivery. Orders promptly attended to.

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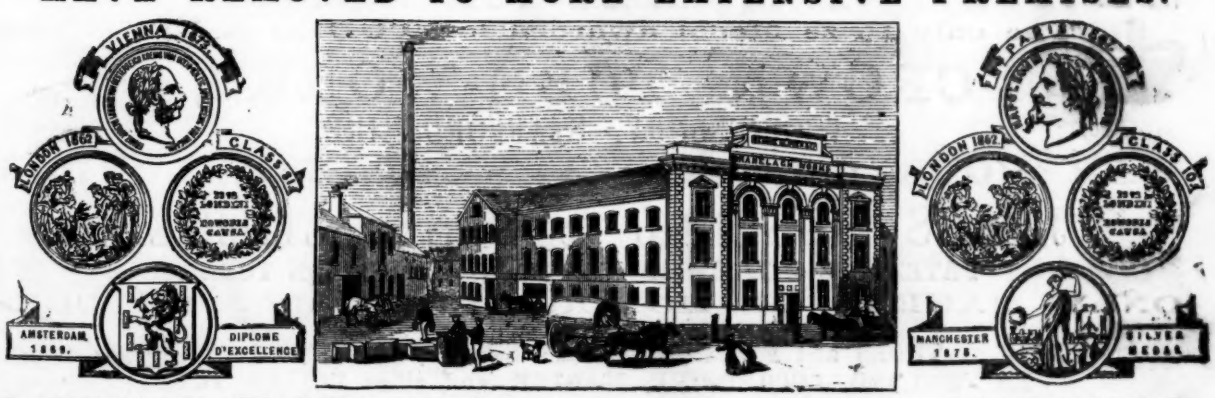
CHANGE OF ADDRESS.

GEORGE GLOVER AND CO.,

DRY GAS-METER MANUFACTURERS,

HAVE REMOVED TO MORE EXTENSIVE PREMISES:



RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

AND

COOMBS WOOD TUBE-WORKS, HALESOWEN,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS,

AND

LAP-WELDED IRON AND HOMOGENEOUS METAL BOILER TUBES,

UP TO FOUR FEET IN DIAMETER.

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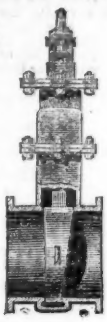
EVERY DESCRIPTION OF TUBING, GAS, STEAM, HYDRAULIC TUBES AND FITTINGS,
EITHER BLACK, GALVANIZED, OR ENAMELLED HOT WATER TUBES AND FITTINGS,
CORE BARS, COILS, COCKS (IRON OR BRASS),
CHANDELIERS, &c., GAS-FITTERS' TOOLS, GAS TONGS, STOCKS, TAPS, DIES, &c., &c.,
HANDRAIL TUBINGS, IRON AND BRASS, PLAIN OR TWISTED,
TELEGRAPH TUBES OR POLES, &c., &c.

C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

ROBT. DEMPSTER & SONS,

GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS;

CONTRACTORS FOR THE

ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

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The only Prize Medal awarded for TUBES & FITTINGS.

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WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

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ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

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TUBES and FITTINGS for GAS, STEAM, and WATER;
LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;
HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.
GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

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CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

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STAR TUBE WORKS, HENEAGE STREET, BIRMINGHAM.

HYDRATED PURIFYING MATERIAL.

Samples on application.

MESSRS. SPENCE BROS., LIMITED,

Will be glad to supply the above on the most favourable terms, and to treat, by Purchase or Exchange, for Spent Oxide.

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ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

VICTORIA CHEMICAL WORKS, BRADFORD, NEAR MANCHESTER.

SULPHATE AMMONIA.

R. W. WALLACE & CO.,

60, MARK LANE, LONDON, E.C.,

Are Buyers of SULPHATE AMMONIA in Large or Small Quantities, or Sell on Commission for Gas Companies and Makers.

PLANT ERECTED ON THE LATEST AND MOST APPROVED PRINCIPLE.

AGENTS to THE GASLIGHT AND COKE COMPANY, LONDON, for the SALE of SULPHATE AMMONIA. Works: BECKTON.

THE

STANDARD WASHER AND SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]

Some of the advantages claimed for this Apparatus are as follow:—

The Exposing of a large Amount of Effectually-wetted Surface (which is continually reproduced) to act upon the Gas.
Unerring Regularity in the Distribution of the Liquor.
Saving of Expense in Providing and Exchanging Scrubbing Material—none being required.
Economy of Space, thus enabling the Apparatus to be protected from the Weather.
Economy of First Cost and of Maintenance.
It works without Pressure.
It is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured.

Applications for Prices, &c., to be made to

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BY

OXIDE OF IRON.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

JOHN WM. O'NEILL, Managing Director.

WELLS, BIRCH, RYDE, and CO., Limited,

HOYLAND SILKSTONE COLLIERIES,

Near BARNSLEY.

This Company is now in a position to raise **2000 tons per day of REAL OLD SILKSTONE GAS COAL.**

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

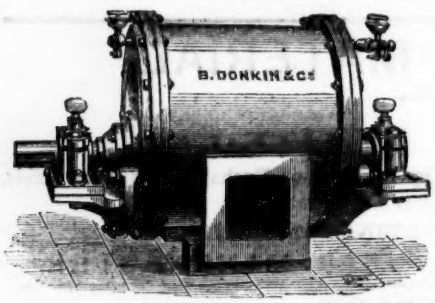
Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.

J. BEALE'S NEW PATENT GAS EXHAUSTERS

MANUFACTURED SOLELY BY

B. DONKIN & Co.



These Exhausters have but one solid slide, which ensures less wear and friction, and thus fewer repairs are necessary. They are made with two outside bearings and with all latest improvements.

MESSRS. B. D. & Co. ALSO MAKE

STEAM-ENGINES FOR DRIVING GAS EXHAUSTERS.
IMPROVED GAS-VALVES.
VALVES FOR AMMONIACAL LIQUOR, TAR, and HYDRAULIC MAINS,
VALVES FOR SPECIAL PURPOSES, WITH COLUMNS, SCALES, AND GAUGES.
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SCREW WATER-VALVES, &c.

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WORKS: 55a, BLUE ANCHOR ROAD, BERMONDSEY, LONDON, S.E.

IMPROVED
COMPENSATING GAS-METER.
HUNT'S PATENT.

This Meter supplies a want long felt, by putting an end to the loss sustained by Gas Companies through the overworking of their Meters.

These Meters can now be supplied in either TIN-PLATE or CAST-IRON CASES, and OLD METERS converted to this plan. GAS COMPANIES and CORPORATIONS will find it to THEIR ADVANTAGE to adopt these Meters.

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"I am able to report that the Meters have given in each test most satisfactory results."—*Mr. H. Sporne, City of London Meter Inspector.*

"I consider the arrangement is a great improvement upon the Meters in present general use."—*Mr. T. Jackson, Meter Inspector, Birmingham.*

"I would observe from the results of my testings that the Meters are a great improvement on the ordinary Wet Meters in general use."—*Mr. H. Airey, Meter Inspector to the Metropolitan Board of Works.*

COPIES OF REPORTS SENT ON APPLICATION.

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WET AND DRY GAS-METER AND GAS APPARATUS MANUFACTURERS,

BELL BARN ROAD, BIRMINGHAM.

Established 1830.

GEORGE ORME & CO.,

ATLAS METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY GAS-METERS,

STATION-METERS, GOVERNORS,

PRESSURE AND EXHAUST REGISTERS,

LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

J. T. B. PORTER & CO.,

GAS ENGINEERS & MANUFACTURERS,

IRONFOUNDERS AND CONTRACTORS,

GOWTS BRIDGE WORKS,

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LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.

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GAS ENGINEERS,

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WET & DRY CONSUMERS GAS-METERS,

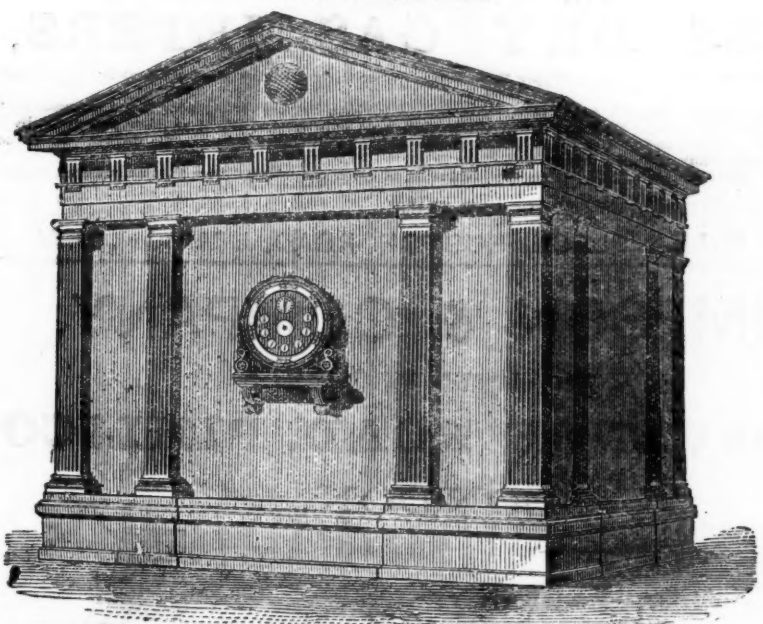
OF THE HIGHEST EXCELLENCE ONLY;

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



SQUARE STATION-METERS,

WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

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C. & W. WALKER'S

WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,

DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

FINSBURY CIRCUS, LONDON.

ESTABLISHED IN 1860.

BENJAMIN CARPENTER,

THE ORIGINAL MANUFACTURER OF THE IMPROVED

WOOD SIEVES

FOR

GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,

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LONDON, N.

DEMPSTER & SONS'

RENOWNED

WOOD SIEVES,

WITH TAPER BARS,

MADE BY MACHINERY

CAPABLE OF MAKING 10,000 FEET WEEKLY.

References to Hundreds of First-Class Engineers.

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ELLAND, NEAR HALIFAX.

JOHN ROMANS, C.E., F.G.S.E.,

CONSULTING GAS ENGINEER

AND

CANNEL COAL FACTOR,

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Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.

GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTER-MIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

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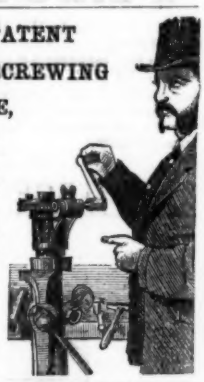
GRIRDROD'S PATENT

PORTABLE PIPE SCREWING

MACHINE,



For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great a tisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,

Brassfounders, Gauge Injector and Tool Makers,

ALBION WORKS, SALFORD,

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THOMAS TURTON AND SONS,

SHEAF AND SPRING WORKS,

SHEFFIELD,

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FOR ENGINEERS,

STEEL OF ALL DESCRIPTIONS,

SCREW STOCKS, TAPS, AND DIES, SPANNERS

RATCHET BRACES, LIFTING-JACKS,

ANVILS, VICES,

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CAMBRIDGE STREET WORKS AND ROLLING MILLS,

BIRMINGHAM.

The following Medals have been awarded:—

GRAND COUNCIL MEDAL, LONDON, 1851. MEDAL, LONDON, 1862. GOLD MEDAL, PARIS, 1867,

The only Gold Medal awarded for "Apparatus and Processes for Heating and Lighting" by the Imperial Commissioners

MEDAL FOR PROGRESS, VIENNA, 1873.

The following Medals were also awarded at Paris, 1878:—

GOLD MEDAL for Chandeliers and Gas-Fittings.

GOLD MEDAL (Rappel) for Metallic Bedsteads and Furniture.

GOLD MEDAL (Rappel) for Art Metal Work. BRONZE MEDAL for Tube Metal and Wire.

MANUFACTURERS OF BRASS AND COPPER SHEETS,

TUBE AND WIRE,

ROLLED METALS, LOCOMOTIVE AND CONDENSER TUBES, CYLINDERS;

Ornamental, Taper, and Cased Tubes; Tin Tubes;

GAS-FITTINGS, CHANDELIERS,

BRACKETS FOR HEATING AND LIGHTING;

METALLIC BEDSTEADS.

Ecclesiastical and Mediæval Metal Workers.

GENERAL BRASSFOUNDERS.

REGISTERED TRADE MARK:

LONDON OFFICES & SHOW-ROOMS: R. W. W. & CO. 141, FLEET STREET, E.C.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

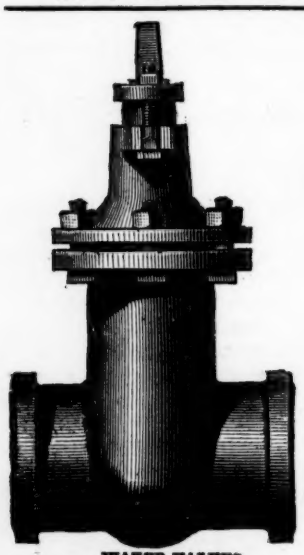
Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.



WATER-VALVES.
All Sizes, Flange and Socket, kept in Stock, tested to 1000 feet head.

SIMPSON & COMPANY,

ENGINE-WORKS,

GROSVENOR ROAD, PIMLICO,

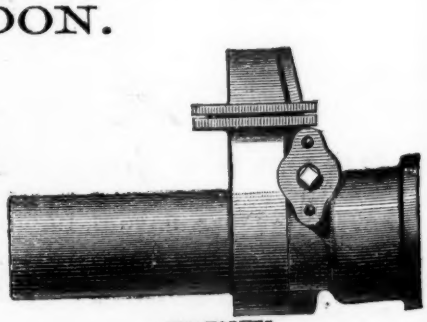
LONDON.

SCREW-COCKS, HYDRANTS,

SLUICES, PENSTOCKS,

And all other Machinery for

WORKS OF WATER SUPPLY, DRAINAGE AND IRRIGATION.



GAS-VALVES.
All Sizes, Flange and Socket, kept in Stock, tested to 100 feet head.

TANGYE BROTHERS AND HOLMAN,

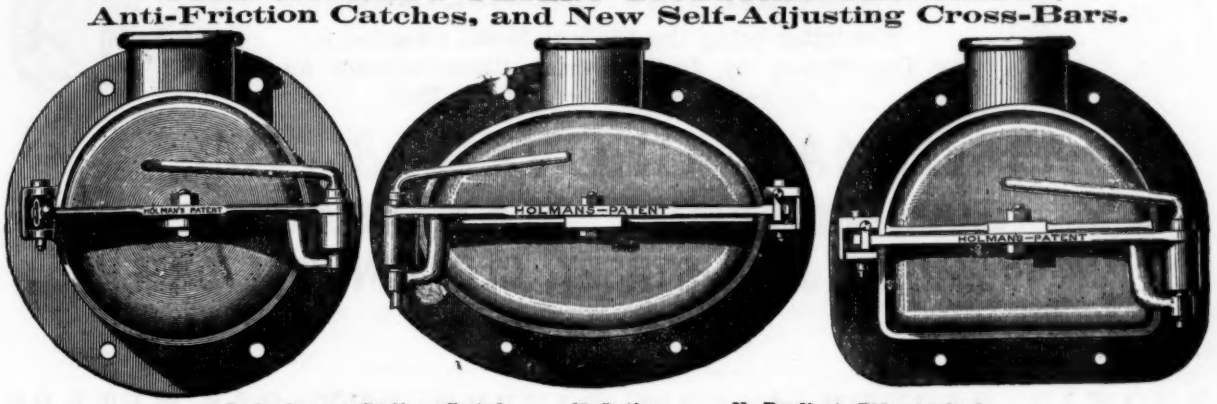
CORNWALL HOUSE, 35, QUEEN VICTORIA STREET, LONDON, E.C.,

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.
Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1859, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,

(Signed) JOHN JOHNSON.

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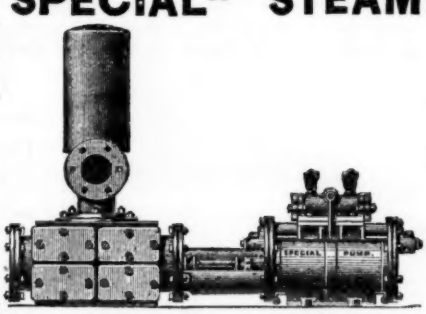
THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
*	4	12	3,250*	30
	5	12	5,070	32 10
*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



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Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

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The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

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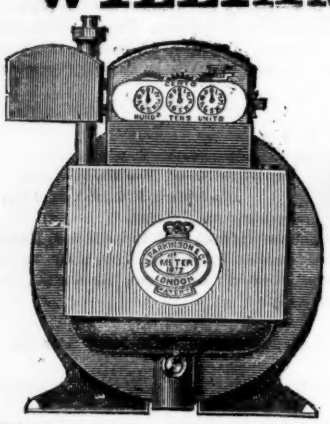
THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.,

(ESTABLISHED 1816,)

MANUFACTURERS OF



WET & DRY METERS,

STATION-METERS & GOVERNORS,

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PRESSURE REGISTERS, EXPERIMENTAL APPARATUS, GAUGES, WATER-METERS, &c.

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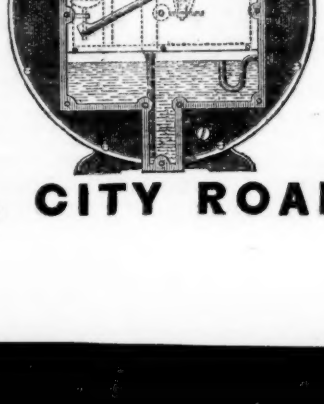
In this Meter, the action of the measuring-drum is reversed. By this arrangement an improvement is effected in the registration at high speeds, which, in many tests, has not varied from the smallest light to three times the capacity of the meter. It works equally well under all pressures. The range of error between the high and low line is much smaller than that allowed by the "Sale of Gas Act."



The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

W. PARKINSON and CO. have made arrangements for the manufacture of these Meters, both in tin and cast-iron cases, and for the alteration of old ones to this principle, which is confidently recommended as possessing every quality that can be desired by Gas Companies, Corporations, or Private Consumers.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 24, 1878.

Circular to Gas Companies.

The electric light may now be said to be in full swing in Metropolitan thoroughfares. It blazes on the Thames Embankment, and now shines along the Holborn Viaduct. Let it once and for all be remembered that we have no antipathy to the electric light. It will never, at all events in its present state of development, interfere with the profitable occupation of Gas Companies; and daily intercourse with some who would be delighted if the interests of those Companies could be successfully assailed, assures us that no general hope is entertained that the one light can ever supersede the other. All admit that the electric light is beautiful, but every one notices the small diffusibility of the illumination. Anybody who will observe the two sides of the Holborn Viaduct in the early hours of the evening—that is to say, the side where well-illuminated shop windows prevail, and the other where no shop windows at all are seen—will notice, just as they must on the Thames Embankment, that while a clear light prevails under the electric lamps, the luminosity within a few yards, when not supported by gas, soon dwindles into absolute darkness. This is not our own opinion. It is what we collect in conversations with numerous persons, many of whom, we are sorry to say, are notoriously opposed to the interests of Gas Companies. As to the photometric effects of the new light, these can now be roughly guessed at; but the cost at which these effects are produced has still to be determined. Our impression is that the experiments are not quite fairly made. The electric light should be displayed entirely without the adventitious aid of coal gas, unless the two lights can be placed under comparable conditions. It is perfectly ridiculous to place a light which is credited with an illuminating power of a thousand candles, in comparison with one which we know to have the luminosity of only seventeen. How little the Gas Companies who are most interested in the matter fear the competition, may be judged by a communication made last week by the Chartered Company to the Metropolitan Board of Works, in which they express "the desire of the Company to offer the Board every "facility, so far as lies within their means, in connection with "the experiment now being made with the electric light, and "stating that they are anxious for the opportunity of dis-"playing the comparative powers of illuminating by gas, and "requesting permission to make such temporary alterations in, "or additions to the public lamps at the 'refuge' at the "Middlesex end of Westminster Bridge as may be desirable; "also stating that they will keep a careful account of cost, "and they will be happy to exchange information with the "Board." This shows plainly enough that the Chartered Company are perfectly willing to assist the Authorities in ascertaining as closely as possible the value of the electric light. The method proposed by the Company, of making a comparative test of the value of the two lights, is the best that could possibly be devised. Some members of the Board object, and wish that an experiment might be made on the parapet wall of the Embankment, which never could be a satisfactory test of the relative value. At the meeting of the Board, we find that the financial statement for the coming year was presented, and, except that we notice the continual creeping up of the rates, there would be little that would call for observation. The statement admits that since the Board commenced their work, a million and a half of people have been added to their district. Miles upon miles of streets have been constructed, which have brought 150,000 houses to be rated; and yet the rates continually go up. Next year they will be, within the fraction of a farthing, sixpence in the pound; and the year after, nobody knows what. It must not be supposed that we object either to the works which the Metropolitan Board have carried out, or to the money they have spent on them. We hold a strong opinion that the work imposed upon the Board has been well done, and at no extravagant cost. Nevertheless, in view of the enormous responsibilities which must be incurred in carrying out their proposed designs on the Gas and Water Companies, we advocate a much wider basis of representation. Vestrydom must be abolished, and direct representation take its place.

If there still remain alarmists in this country who have a fear that electricity is about to supersede gas, we may assure them that such characters do not exist in America, the home of the great genius which is to revolutionize the illumination of our houses and streets. It has been said, on good authority, that a man is never a prophet in his own country, and certainly the feeling with which Mr. Edison is regarded in New Jersey would induce the belief that the remark is eminently applicable in his case. That he is a man of some genius, there can be no doubt; but, that he is destined to extinguish gas, can well be questioned; at all events, he has occasioned no scare in America, where gas property has continued to maintain its value.

The Town Council of Liverpool have received a most able report on the electric light from their Engineer, Mr. Deacon, who seems to have given a most attentive study to the matter. While expressing a decided opinion that the new light may be available, and indeed desirable, in large halls and workshops, he more than hesitates to recommend its adoption for street illumination. As regards cost, he shows—basing his belief on what he learned in Paris—that the cost of the electric light far exceeds that of gas. He states, for example, that the thirty-two lamps on the Place de l'Opéra cost £1 0s. 6d. per hour, while the same amount of illumination could be obtained from gas, at the Liverpool price, for 3s. 4d. per hour. These figures agree pretty closely with those of others who have gone into the matter, and they are, no doubt, substantially accurate. However, the cost will, no doubt, be tested at Liverpool, for the Town Council have it under consideration to light up Lime Street by means of the Jablochkoff system.

The Vestry of St. Pancras are extremely wroth at the quite innocent paragraph which we inserted in last week's "Cir-"cular," relating to the gas-testing in the parish. There was one statement which we must correct. We speculated that the apparatus at the St. Pancras testing-place might be incomplete, but we are assured that it is most complete, and in perfect order. We are very glad to have this assurance; but then, what can be the reason the Parish Gas Examiner finds the gas so poor, while the Official Examiner finds it so good? We should like to know what burner is employed? Of course, if the use of the Sugg-Letheby burner be continued, that would account for all. Still, it would be exceedingly unjust to the Gas Company to continue the employment of an instrument which it has been well established does not give the true value of the gas. The new "London" Argand is called by some a "juggle" burner.

It is no such thing, for it cannot get out of the gas what is not in it. If another burner be invented which will add two more candles illuminating power, that will represent, in strict truth, the real value of the gas. We notice that, on the report to which we alluded last week, the Vestry found a prosecution of the Chartered Company; that is, if they have the power to do so. We entertain a strong opinion that no prosecution can be instituted against a Metropolitan Gas Company under recent legislation, except by the Metropolitan Board of Works, and then only on the report of their own officers, and in the absence of appeal to the Chief Gas Examiner. There may be a doubt about it, but we should be very sorry to see the money of the St. Pancras ratepayers squandered in getting the matter set at rest. To our minds, the law, as we interpret it, is quite sufficient for the protection of the public, who, as it is, pay pretty heavily for gas-testing. In connection with this matter, we may mention that the August report of the St. Pancras Examiner stated that the maximum illuminating power of the gas supplied in that month was 21·5 candles; the minimum, 17·2; and the average, 18·65. These numbers appear to us as much too high as those for last month are too low. There really must be something wrong somewhere.

An ingenious application of Pintsch's system of compressed oil gas has been made in the construction of light buoys to be anchored off wrecks, &c. A cheap and easy method of affording a warning light on these spots has long been desired; and, so far as regards the duration of the illumination, that, of course, will only be limited by the capacity of the buoy into which the gas is compressed. An experiment has been made with one of these buoys which burned without intermission for thirty-four days, but what light it afforded we are not informed. If no better than that given by the same system, as applied in railway carriages, we cannot imagine that the buoys will be of much use at sea. Further, the gas must be consumed at great waste to burn throughout the twenty-four hours. The idea, however, is a very excellent one, and perhaps some automatic arrangement can be invented by means of which the amount of gas consumed in the daytime may be reduced.

At the present moment it is a matter of great consideration for Gas Companies how best to promote consumption of gas, and add to their profits so far as the Legislature will allow. We have repeatedly dwelt upon the duty of Companies to promote, as far as possible, the use of gas for heating purposes, and, further, the desirability of their assisting consumers with, if nothing more, sound advice in the selection and arrangement of internal fittings in general. We have pointed out, having in our minds the serious responsibilities which Gas Companies incur when they undertake fittings, whether or not it is really advisable for them to do work of the kind. The better plan to follow would be that of which a precedent was set by the Liverpool United Gas Company—namely, the formation of what Mr. Wilson, in a communication published in another column, calls an "Auxiliary Company," by whose agency the work may be done without at all affecting the profits of the Gas Company, and as the profits of the Auxiliary Company may possibly exceed those which can be divided by the Gas Company, we have no doubt that Auxiliary Companies would be well supported. We commend Mr. Wilson's ideas to the consideration of Gas Companies generally, and hope the matter will receive attention.

The Oldbury Local Board are in doubt as to whether they shall make their own gas, when they obtain the underground plant which they have purchased from the Birmingham Corporation, or whether they shall take gas in bulk and distribute it to their own consumers. It is a question entirely for the Board, who will, of course, take the advice of some qualified Engineer, who will tell them which mode of procedure offers the best means of making profits; or, as we ought to say, following our usual line of argument, how they can supply their consumers at the lowest rate. It is a matter in which we can only recommend them to take advice other than that offered by Mr. Chamberlain.

Bradford is, under the auspices of the Corporation, to have its exhibition of apparatus for the use of gas for cooking purposes and the production of motive force. The latter, we are pleased to see, it is proposed by some to make a principal feature. All may not be readily accomplished that the promoters expect; but there certainly is the possibility that the use of gas-engines may be greatly extended, leading to a reduction in the number of the tall chimneys which vomit forth their black smoke, and make the atmosphere in the neighbourhood little better than a dense fog. It was recently suggested to us that Gas Companies should combine in offering a large prize for the invention of more powerful gas-engines, and the matter is one which is really worth some consideration.

Water and Sanitary Notes.

The Sanitary Institute of Great Britain is a very ambitious body. At present it consists of nobody exactly knows who. For the future, if we understand matters rightly, it is to be composed of gentlemen and ladies who will be content to pay a small annual capitation fee. But the designs of the promoters extend a little further, and their object is now to obtain a Charter of Incorporation, which will empower them to subject all Borough Surveyors to an examination, and receive a certificate of competency from the Institute, before they can obtain public employment. There is a very expressive action in which the thumb and the nose are mainly concerned, which indicates very plainly the thoughts of the actors as to the proposed scheme. Mr. Ellice Clarke, who probably understands as much about the sentiments of Surveyors as any man in England, has been endeavouring to ascertain their views as to the proposed new constitution of the Institute. In reply to one hundred and fifty inquiries, he obtained seventy-five answers, and found that out of these only one was in favour of the proposed examination. The examination dodge is, in fact, being done to death. It is, for the most part, only promoted by men who could not pass an examination if their lives depended upon it. We should like to see fussy members of the Society of Arts and other societies put through their facings in order to ascertain their right to demand from others the possession of knowledge which they have not themselves. Why, for instance, should Sir Antonio Brady trouble himself about the qualification of Borough Surveyors, when men fully competent to be really judges of the state of the matter, like Mr. Ellice Clarke, come forward and tell us what should be done. We recommend every Borough Surveyor to keep wide aloof from the *dilettanti* of the Adelphi.

The Corporation of Colchester are determined, if they can, to make a compulsory purchase of the water-works which now supply that borough—not city, be it understood. We cannot understand what concatenation of circumstances could possibly have led us recently to think that Colchester was a cathedral city with a real live bishop, who could hardly be expected to flourish in such a neighbourhood. An Association, which is, at all events, with every propriety, termed a Company, at present supplies the borough and district with water—very good water, and in fair quantity. The Proprietors of the Company have done now what they ought to have done years ago—applied for a Special Act of Incorporation, which would place them under the most recent legislation, as it affects water supply. The object is laudable, and by anybody in the kingdom but the Corporation of Colchester would be deemed praiseworthy. As it stands, however, the Town Council have decided on opposing the measure—that is, if they can. They, doubtless, understand that before they can oppose a Bill in Parliament they must get the sanction of a town's meeting, under the Borough Funds Act, 1872, about which, at the present moment, they say nothing. Now, the ratepayers of Colchester are a thrifty class. They have never ceased to grieve over the £1000 they spent uselessly a few years ago in the opposition to the Gas Company; and if any one with the smallest influence forces the matter on the attention of the ratepayers, we have little doubt they will hesitate in the venture. The Town Council's proposition is nothing more nor less than this—to effect a compulsory purchase of the undertaking. It is open to them to make terms with the Proprietors if they can, otherwise the case must be fought out before Parliament; at what cost, and with what result, we cannot say.

The Oswaldtwistle Local Board take their water supply from nearly the same source as the Wakefield Corporation, and are very anxious to obtain their water as pure as possible. They will probably not find it purer if they filter it carefully through "magnetic carbide," than if filtered through sand. What magnetic carbide is we do not know, and probably never shall know. It is perhaps as good as sand, if no better, and Oswaldtwistle may safely rely on its efficacy as a purifying medium.

The Glasgow Water Commissioners have before them a Bill which is unavoidably required to extend the powers they acquired under their Act of 1876 to furnish a supply of water from the Clyde for the exclusive use of manufacturers. It is so important to the manufacturing community of Glasgow that the powers asked for by this Bill should be granted, that we hope no opposition will be raised. All that could be urged for a measure of this kind was brought forward in 1876. The main reason for the promotion of the Bill we notice to-day is the failure of a contractor to fulfil his obligations.

The half-yearly meeting of the Chelsea Water-Works Company was held on the 19th inst., when a dividend at the rate of six per cent. per annum was declared. It is satisfactory to know

that the new works of the Company at Molesey are now completed, and we have the authority of Lieut.-Col. Bolton that they are acting with complete efficiency. We expect now that we shall have no more complaints of the water supplied by the Chelsea Water Company. But the work has been done at a very large cost. No less a sum than £204,678 has been spent upon it, and for this expenditure, not a single consumer has been added to the roll on the Company's books. It is very gratifying to learn that an extension of the constant service system is being carried out in the Company's district; but it is only within what we may call, without offence, their genteel limits. Several estates are being laid out for a good class of houses, and for these the Company wisely provide a constant supply. We hope that they will gradually introduce it into poorer districts, where it will be more useful, and be better appreciated. We may just remark here that the condition of the Metropolitan Water Supply was never more efficient than at the present time. It was unfortunate for the Metropolitan Board of Works that they chose the present moment for making an attack on the Companies; but that is now all past, and we need say no more about the matter.

Will nothing stay the desire of Mr. E. Chadwick, C.B., for notoriety? His last communication to the Society of Arts is on "Sewage Farms in Horticultural Competitions." Everybody knows that bloated mangolds and dropsical swedes can be grown on sewage farms. They can be grown just as easily where the farms are irrigated by simple water as where noxious muck—which Nature unhappily admits into growing plants when it is offered to them—is employed. A great deal must be done before the relative value of a root grown on a sewage farm, and another grown on ground manured by solids, can be determined. We want an examination of the roots made by competent analysts, who could tell us what relative proportions of solid and aqueous constituents are taken up. We have a suspicion—and it is, in fact, more than a suspicion—that the roots grown on sewage farms contain an abnormal proportion of what can only be considered as liquid sewage matter. We will not quote the opinion of the late Mr. Alfred Smee, who used to say that everything grown on a sewage farm smelt and tasted of sewage. We simply ask for a full and complete investigation of the condition of the plants which are grown under the dry manure system and what we may call the wet. Perhaps the A. B. C. Company can furnish Mr. Chadwick with valuable information on this point.

Sale of Gas Shares at Folkestone.—Last Tuesday, 17 original £10 shares in the Folkestone Gas Company were sold by auction, and most of them realized £18 12s. 6d. each, the others only a few shillings less; while new 7 per cent. shares of 1876 fetched £13 and £13 2s. 6d. each. This is a considerable advance on recent prices, for a few weeks since some of the original shares sold as low as £15 10s.

Exhibition of Gas Apparatus at Hinckley.—On Tuesday, the 10th inst., and two following days, a very successful exhibition of gas apparatus was held at the Town Hall, Hinckley. On the first day more than 2000 people visited the hall, and seemed much gratified with the apparatus on view. The arrangements were under the immediate superintendence of Mr. J. Surl, the Manager of the Hinckley Gaslight and Coke Company, and we learn that about £350 worth of apparatus of all descriptions was sold. This must tend largely to increase the consumption of gas in the town, and if, as we gather from a reported speech of one of the Directors of the Gas Company, at an ordinary held on the Wednesday afternoon, the price of gas is to be considerably reduced at the beginning of the new year, it appears that everything possible is being done there to popularize its use.

Edison's Electric Light Patent.—Last week, before the Solicitor-General, the objections were heard to the grant of provisional protection for six months to the patent of Thomas Alva Edison (No. 4226, dated Oct. 23, 1878), for "Improvements in the Method of, and Means for Developing Electric Currents, and Lighting by Electricity." The objector was a Mr. John Huddart Russell, who, it was stated, has a pecuniary interest in a patent granted to Mons. A. Arnaud (No. 4074, dated Oct. 14, 1878), for "A Mode of Indefinitely Dividing Electric Currents." The grounds of the objection were that Edison was not the true and first inventor of the improvements, or some of them. An adjournment of the hearing from Monday to Friday was granted, to enable evidence to be filed in support of the objection. In the result, however, the Solicitor-General decided that Edison's application for a patent should be allowed to proceed, and that the costs of the present opposition should be paid by Mr. Russell.

Newington (Yorks) Water Supply.—At a meeting of the Newington Local Board, on Monday, the 16th inst.—Mr. H. Walton in the chair—Mr. Williamson moved that a Committee of seven members be appointed, to be called the Water-Works Committee, to be empowered to enter into negotiations for the purchase, by arbitration, of the Newington Water-Works. In moving the resolution, he said the question had been under the consideration of the inhabitants for a considerable period, but the time had now come when the subject of the water supply should be seriously taken in hand. Complaints had been made against the Water Company, but no redress had been obtained. The inhabitants could now get the works as cheaply as they were ever likely to do, and the price would be fixed by arbitration. They were in danger of being swallowed up by the Hull borough, and the possession of the water-works would be one bulwark, in their defence, in trying to keep themselves as an independent body. Mr. Harding seconded the motion. Mr. Hart moved as an amendment, that the matter be adjourned *sine die*. He said that the purchasing of the works would cause a very serious loss to the district, inasmuch as the rent would never cover the interest on the first cost. Mr. Shaw seconded the amendment, but after some discussion the motion was carried.

THE JABLOCHKOFF "CANDLE."

The electric light, in the form of the Jablochkoff "candle," is now fairly on its trial in the great Metropolis. The City Authorities are employing it at Billingsgate and on the Holborn Viaduct, while the Metropolitan Board are conducting an elaborate experiment on the Victoria Embankment. At Billingsgate the first effort was a comparative failure, but better results are shortly expected. The prominence thus given to the Jablochkoff entitles this particular development of the electric light to especial consideration. Some amount of expense, as well as trouble, will be incurred by the Authorities in connection with these trials, and we may presume that both the City and the Metropolitan Board are influenced by a hope that the electric light will in some degree supersede gas. At present the public are pleased with what they see. The illumination on the Thames Embankment has proved more effectual than was at one time expected, though it evidently fails to accomplish that which was originally claimed for it. Thus at the outset we were promised that twenty Jablochkoff candles would light up one side of the Embankment, all the way from Blackfriars to Westminster. More modestly, the trial has been made with twenty lights beginning at Waterloo Bridge, leaving the section from Waterloo to Blackfriars still under the reign of gas. The range is now 1170 yards, with the lamps at unequal intervals, though in most instances they are forty yards apart. The average distance is sixty yards. The light is good, but if it were distributed eastward as far as Blackfriars Bridge, the intervals would be too great for effective illumination. As the case stands, the gaslights on the parapet and on the kerb of the river-side pavement might be dispensed with, and possibly some of the gas-lamps on the other side of the road also. If the Jablochkoff light were in the centre of the roadway, its lustre would be sufficient to take in the entire breadth of the road and the two footways. But we cannot conceive that a longer line than the present one would be satisfactorily lighted by the present "candles." We have just been informed that the Metropolitan Board intend not to light the gas-lamps on the parapet and the adjacent footway between Waterloo and Westminster Bridges on and after this (Tuesday) evening. The electric light will thus be put to a better test.

So far as the emission of light is concerned, the Jablochkoff candle has acquitted itself extremely well on the Embankment. On the Viaduct the results are much the same. But this is not the end of the story. Every hour and a half, or perhaps a little oftener, a man goes up a ladder on the Embankment to change the direction of the current in each lamp. He just touches the commutator, and the work is done. Still, there is the going up and the coming down again, together with the carrying of the ladder from pillar to post. This clumsy ladder-carrying was got rid of by the London Gas Companies long ago, and it is rather curious that it should be adopted by the new illuminati. The Société Générale d'Electricité have an automatic arrangement for switching the currents, but it possesses a certain defect which requires to be remedied to render it thoroughly efficient. The arrangement is such that when the candle has burned down nearly all the way, the apparatus comes into action, and the current is switched off to the next candle. But if the candle by any means—as by a gust of wind—happens to go out before burning down to the proper point, the automatic arrangement will not act. It is not quite clear that such an objection ought to be fatal to the use of the contrivance, seeing that matters are made none the worse by it, and it is not often that a candle will go out prematurely. Still, as a matter of fact, the automatic arrangement remains in the background, and the man with the ladder is to be found on the Embankment. It would have been a much neater arrangement if the commutators, instead of being attached to the carbon-holder of each lamp, had been placed down in the subway. There is an economy of wire in the present arrangement, but there is a very obvious awkwardness. On the Viaduct, the commutator is fixed in the hollow base of the lamp-post, which is admirably adapted for the purpose. At Billingsgate, the commutators are fixed against the wall, not far from each lamp.

The switching arrangement is a clumsy element in the management of the Jablochkoff light. There are about three thousand eight hundred gas-lamps in the City alone, and if these were superseded by the Jablochkoff candles, though the number would be very much reduced, yet the amount of attention required would be rather serious. The limited duration of the light also has to be considered in another way. There are four Jablochkoff candles in each lamp on the Embankment, and six on the Viaduct. If the light is kindled at five o'clock, the latter will go out at two in the morning, and the former at eleven o'clock at night, although darkness will continue until seven in the

morning. Practically, we believe, the candles will not last so long. Moreover, at the present time the aid of artificial light in the streets of London is needed at four o'clock, bringing the termination of the electric light on the Thames Embankment as early as ten o'clock, or half-past nine. If the electric light is to be continued for a longer period, there must be a renewal of candles, furnishing another complication in addition to the switching business. Other systems are comparatively free from these defects, but in no instance is a continuous light commanded with the facility of gas. Mr. Edison claims to have mastered this difficulty; but the exact nature of his invention is still concealed from us. A certain result may be gained, but it is necessary to know whether there may not be some accompanying disadvantage. The electric light, as devised by other inventors, if described by its good properties alone, would appear to be perfection. But we know that it has its drawbacks, and certainly it has not yet reached perfection.

The risk of a breakdown with the electric light is not to be overlooked. There is a steam-engine, and there are one or two electric machines. At present we hear of no imaginable means for storing up electricity, so as to create a reserve on which to draw during an emergency. The engine may suddenly fail, or the electric machines get out of order. Billingsgate affords an example of what may be the result of a single nail getting in the way. Estimates of cost must be materially affected by the necessity for having engines and machinery in duplicate. Let us imagine gas-works without gasholders, and with the liability of having their retorts quenched in a second of time. Such is the condition under which the electric light is produced. The current which feeds the light is spent as fast as it is created, and if the steam-engine merely falls off in the number of the revolutions which it produces, the effect may be fatal. We may also observe that, if the Jablochkoff candle goes out, it cannot be relighted, except by temporarily placing some conducting substance across the tops of the carbons. It is pleaded that with the electric light there is no risk of explosion. Yet the boiler may burst where the light is being manufactured, and the current which traverses the wires is in some cases sufficiently powerful to be highly dangerous if by any means it finds part of the human body in its circuit. The argument that the light gives off no noxious fumes has also been pretty generally accepted, though it is likely now to receive a check. Some of our readers may remember the days when the late Dr. Letheby and others raised an outcry against the sulphur constituents in gas, which in their combustion formed sulphurous acid. The presence of sulphur in gas has been the subject of many sensational appeals. But the electric light bids fair to transcend the sulphur panic. Mr. T. Wills has proved by actual experiment that the electric light, as sustained by a Foucault regulator, evolves at least ten or twelve grains per hour of nitric acid! If ever the electric light becomes the basis of a "monopoly," we may expect to find the Local Authorities demanding material guarantees against the combination of oxygen and nitrogen. There is the old proverb of changing servants and changing faults. The defects and transgressions of gas are known, and have been made the most of. The faults of the electric light have yet in a great measure to be found out. "I defy any one," said an unhappy householder, "to dis-"cover the nuisances of a house until he has lived in it." So we shall never know the faults of the electric light until we have gained knowledge by experience.

The distance to which the electric light can be transmitted is a matter of high economical consideration. The longest range on the Embankment at present is seven hundred yards. At that distance the light shows no falling off. Possibly the range may be extended. On the works of the Société the light has been maintained at the extremity of a wire fifteen hundred mètres long. But we are not yet assured that a series of lights could be kept up on a circuit extending to so great a distance. Experience, we believe, has not gone beyond eight hundred yards in this way. Reverting again to the case of the City, we may reckon that something like a thousand Jablochkoff lights would be required to illuminate the streets. If there were only twenty in connection with each duplex machine, there would be a necessity for fifty steam-engines, to say nothing of the duplicates. This does not say much for the practicability of street lighting by electricity. As to the amount of light given by a Jablochkoff candle, we shall know more when Mr. Keates has made his intended series of observations on the Embankment. It is not unlikely that the estimate of a thousand standard candles for each Jablochkoff light will prove somewhat excessive. Care will doubtless be exercised as to the line of light, for much depends on this. The line of maximum light with the Jablochkoff is understood to incline upwards, so that a strictly horizontal observation would be unfair. It would be well, for the purpose of street lighting, if the Jablochkoff lamps were fitted with overhead reflectors to throw the rays downwards. This plan is being adopted at Billingsgate, and we may observe that gas-lamps would gain by a similar arrangement. As viewed from the surrounding country, the glow which rests over London on a dark Sunday night is indicative of the enormous waste of light there is continually taking place skywards.

The failure of the electric light at Billingsgate, a few weeks back, will probably be repaired on a future occasion; but, in the meantime, the occurrence is instructive. It has been suggested that the gas was remarkably good that night. We have taken the trouble to test this suggestion. It happened at the time that the Beckton testing-station was closed for repairs; but the illuminating power on the works was seventeen candles, according to the average of twelve testings during the twenty-four hours. The Bow Common gas, which mixed with the Beckton, and flowed on with it into the City, was officially reported at 17·1 candles. As a proof that there was no special excellence in the Billingsgate supply, we may observe that the official return, in reference to the gas at Notting Hill, which is supplied from the works at Kensal Green, showed a lighting power of 17·3 candles on the night of the Billingsgate trial. It is, perhaps, to be regretted that the Beckton testing-station was closed at the time; but this was only a fortuitous coincidence, and, we believe, no one ever expected the gas to excel the electric light in point of brilliancy. As to cost, that is a matter on which much remains to be said, and on which the commercial issue altogether depends. The concentration of the electric light greatly diminishes its effective brilliancy, as illustrated by the fact that Mr. Keates's photometer lamp of sixteen candles, at a distance of one foot, would be equal to the naked Jablochkoff light of a thousand candles at a distance of eight feet, and the shaded light of five hundred candles at less than six feet. If it proves that the intrinsic brilliancy of the electric light has been overestimated, gas will suffer still less by comparison. It must, however, be remembered that the Jablochkoff candle is not the only form in which electricity undertakes to compete with gas. Other modes of applying the current have to be considered, including those of Rapieff and Werdermann. As for Mr. Edison, he is surrounding himself with a maze of patents, so that our knowledge of what he is really doing will only be obtained by instalments. It appears certain that he obtains his light by incandescence, a method which is favourable to subdivision, but which has often been tried with disappointing results. Concerning the Jablochkoff candle, we may further observe that there has been one trial of the light which has not attracted much notice. Messrs. Shoolbred, the well-known drapers of the Tottenham Court Road, had six Jablochkoff lights set up in their business premises a short time ago, and they were so well satisfied that they ordered six more. They found, as was to be expected, that their goods displayed the tints of daylight when lighted up by electricity, a result which was particularly advantageous on foggy days. But on the occasion of the recent display of gas *versus* electricity at the offices of the Chartered Gas Company in the Horseferry Road, it was shown that gas enriched with naphthaline, according to the Albo-Carbon method, was capable of bringing out all the tints of a pattern card, in a manner comparable to electricity itself. Respecting the electric light, it is necessary neither to underrate its peculiar merits, nor to overlook its drawbacks. Exaggeration, also, has to be avoided on either side. A letter in yesterday's *Times*, quoting from a report of the German Continental Gas Association, gives certain calculations to show that the cost of the conducting wires for the electric light increases enormously with the distance. For the present we have grave doubts as to the practical correctness of the data thus given. We very much doubt whether the experience gained on the Thames Embankment will confirm such figures. That there are very great and growing difficulties as the circuit is extended, is doubtless quite true; but the ratio in which those difficulties increase seems to be less in practice than in theory. Still, if we take a view of the question all round, we come to one very convincing test as to the market value of electricity. Who, we ask, would care at the present time to buy shares in an electric light company at the same premium which gas shares are found to command? The Edison "scare" is clearly on the wane, and the whole question may resolve itself at last into a very ordinary affair—a modification, it may be, of the existing order of things, but certainly not a revolution.

THE DRAINAGE OF WINDSOR.—Last Wednesday, a meeting of the Windsor Town Council was held, for the purpose of affixing the Corporation seal to the documents necessary to obtain an instalment of £5951 of the last loan of £12,951 from the Public Works Loan Commissioners. This loan raises the total amount borrowed for the drainage works to £42,951.

Communicated Article.

THE EXTENDED USE OF GAS.

By Mr. A. F. Wilson, Assoc. Inst. C.E.

The yearly increasing consumption of gas has hitherto been so considerable that gas companies have, as a rule, found their principal difficulty in providing and maintaining plant to keep pace with the demand; consequently, the need has only, in exceptional instances, been felt, of studying and, to some extent, identifying themselves with the interests of consumers.

That cases, however, exist where, without feeling the need, and, in fact, in the face of a constant and large spontaneous increase of consumption, the question of such identity of interests has been both studied and, by practical measures, given effect to, is within the knowledge of most persons who know anything about the matter. All honour, therefore, to those who, without the spur of necessity, have thus intelligently come forward, and whose measures—thus far successful—point the way to further possible development.

Hitherto, for lighting purposes, gas has been king; and there is every probability that for many years to come it will remain so. A brilliant competitor, in the shape of the electric arc, has, however, lately come prominently forward, and threatens to dispute the throne; and it is, of course, impossible to assert that invention may not, in time, discover means to make the rivalry in certain positions pecuniarily of account. Hence the necessity of carefully considering the prospect of maintaining a healthy increase in the consumption of gas, should fields which are now in its possession become appropriated by its rival.

A conspicuous point in discussing the relative advantages of gas and electricity is the absence, in the latter, of appreciable heat. This at once brings into notice an obvious extension of the use of gas. Heat is necessary, not only for imparting warmth to our dwellings, but also for their ventilation; it is necessary for cooking our food, and it is the source of force in mechanics, which again may become either motive power or light.

Reversing the order of these possible uses of gas, heat—the last, albeit not the least important—may be somewhat cursorily considered, simply because, as exemplified in the latest improved gas-engine, it will, on its merits, make the required head-way in its proper sphere of operations, without extraneous assistance. The gas-engine enters the market backed by the indirect assistance of the Insurance Companies, who exact no increased premium on their fire policies from its presence—a favour not extended to the engine driven by steam, where the boiler is also on the premises. It is cleanly and safe, and at a distance from coal pits it is probably, even upon the fuel account, economical. Added to this, where its advantages are thus appreciable, its cost is not a barrier to its employment, the question of purchase being determined, not by sentiment or caprice, but upon clearly defined business advantages. The gas-engine, as it now is, may probably be capable of still further improvement; and such improvement, when it is effected, will no doubt tend towards its more general application; but this is a matter which must be left to the march of invention, and will follow as a sequence to its already recognized utility.

Cooking by gas has not an equally clear path, and possibly measures may be advisable to facilitate the employment of cooking stoves. Many gas companies are of this opinion, and some have adopted the system of hiring such stoves to their consumers at a very moderate rental, looking principally to ulterior benefit from increased consumption of gas.

So far as it goes, this is praiseworthy; and if all companies were to adopt the principle, and extend it, not only to cooking stoves, but also to other apparatus in which, for other purposes, the use of gas encounters similar obstacles, then probably this article might never have been written. Practical difficulties intervene, however, even in this. It is doubtful whether those companies who, without special statutory powers, have undertaken such system of stove-hiring, are not acting simply on the individual responsibility of the directors who sanction such measures. It is also dubious how far, in the interests of shareholders, it is fair to carry on a somewhat risky trade of this kind under parliamentary restriction of profit margin, such as has become the rule with regard to dividends which they may declare; and it will certainly be an inconvenience should they, in consequence of thus employing capital, be forced more frequently to apply to Parliament for increased powers of raising such capital, seeing that every fresh application of this kind is now taken advantage of, either to curtail privileges which they enjoy, or to exact more stringent terms of procedure than those hitherto enforced.

From a consumer's point of view, again, the matter stands thus: A., who may be supposed to reside in some district where the gas company do not furnish stoves for hire, desires to add to his kitchen arrangements a gas-cooking stove, but is entirely ignorant of the first principles of gas consumption, or of the most suitable construction of such an article. He may, it is true, obtain this information by studying published treatises on the subject; but, as a rule, he does not do so, and the consequence is that, probably at considerable outlay, he purchases and fixes a stove which is *not* perfectly designed for the purpose it is sold for. The burner is so placed that an explosion, more or less severe, takes place while it is being lighted, and the products of combustion are not got rid of as they should be. A., consequently, cannot recommend the system as faultless to his friends, and although probably he quietly puts up with the disadvantages we have noted, he certainly feels that his purchase is neither so useful nor so agreeable to him as it otherwise would be.

Consumption of gas by cooking stoves has this advantage to gas companies, that it goes on more or less equally all the year round, so that their plant is utilized in the same proportion in the summer as during the winter season. It has the disadvantage, no doubt, of entailing a slight increase in the day pressure upon the mains, and this is a factor of some importance in the calculation; but, upon the whole, it is a point which may, under existing arrangements, be dealt with, because the apparatus, as provided by the maker, is complete for fixing, and may with equal facility be removed when a change is necessary. Things, however, are not apparently so easy to deal with when we attempt to pass beyond this somewhat limited area of action.

Our taste and our interests alike concur, as a rule, in delegating to each individual or corporation a distinct duty, and it is assumed that the duty of the gas company terminates at the meter, the consumer being left to utilize the gas so supplied at his pleasure.

As circumstances, however, are now threatening—probably only threatening—to change a little, the question arises, whether this hard and fast line is altogether a proper principle on which to continue to work. The gas companies have, in their directors, and as their managers, men of high scientific knowledge, and they have organizations fitted to deal with the due observance of regulations which would probably conduce to better results in the consumption of gas than are now attained. The ordinary consumer—at all events, until the School Board generation becomes more fully developed—cannot be credited either with a thorough cognizance of the material he is dealing with, nor does he, as a rule, care to expend any sum for alteration, even should his knowledge of what is required be sufficient. Consequently, he neglects to utilize, for the purposes, and in the way it might and should be, an agent which is capable of various and economical uses. The companies have to bear the brunt of popular clamour, which accuses them of not supplying what they really do supply, and they, at the same time, lose the benefit of an extended trade, which, although it might not render their business, under existing parliamentary enactments, much more lucrative, would at least increase the security of their investments.

So far as the mere arrangement of burners is concerned, the matter is simple. The comparative advantages of the different kinds of burners can be easily ascertained, tabulated, and the information conveyed to consumers, upon the meter-index card with which they are generally furnished; but there is something beyond this that is necessary, and to consider which we must again refer to our new-old acquaintance, the electric light.

Apart from cost, what is the great benefit which is constantly insisted upon in the use of electricity as a light? It does not appreciably vitiate the atmosphere in which it makes itself visible. Why is gas disapproved of? Because it vitiates the atmosphere. Why does gas vitiate the atmosphere? Because the lights are not so arranged that the products of combustion can, by ordinary ventilation, be efficiently get rid of; nor, as a rule, in other than high-class houses, is ventilation at all thought of.

This vitiation of the atmosphere, however, is, after all, not so universally important as it appears to be. The principal product of combustion is carbonic acid, and this is a suffocating rather than an absolutely poisonous gas. We exhale the same compound from our lungs with every breath, and it exists abundantly in the open air wherever vegetation is found. In open areas or freely ventilated establishments, no real practical reason exists for greater care than is now observed; it is principally in close apartments, or in badly ventilated buildings, where the application of scientific rules would have a beneficial effect. What, for instance, in a closed room, and from a sanitary point of view, is the best way to apply gaslight? Doubtless, by means of what is known as the sun burner, which ventilates, like a furnace underneath a chimney-shaft, the apartment it illuminates; but the light is expensive, because its brilliancy is really concentrated at a point distant from the part it is meant for. What we want are diffused lights, combining also the ventilating advantages of the sun light; but we also want some authority to take up this question properly, and explain it to the masses. We want the chandelier withdrawn from consideration as an article solely of taste, chosen for its graceful outline and harmony with the furniture, and we want instead to make it a part of the house, in concord with the architecture, but constructed so as to ventilate as well as illuminate. It might even be so arranged, however, to do more than this, as means could easily be devised so that the heat generated and thus utilized as a ventilator would impart warmth to the room immediately above, by radiation from the shaft conveying away the combustion products.

But, assuming these principles to be popularly, or even to a limited extent, recognized, how can they practically be brought into operation? No doubt that is *the* question.

Builders construct houses so that the rental shall pay as large an interest upon the capital as they possibly can achieve, and, as a consequence, they eschew all fittings which the prospective tenant may be persuaded to purchase. The tenant, on his part, does not feel warranted in going to expense for sanitary arrangements in a house which he may shortly have to leave, and thus between them the matter falls to the ground. The tenant has the greater interest, because his health and comfort are at stake, but health and comfort have probably no fixed value in his mind, and he is naturally uncertain whether the promised economy may balance the outlay he must incur. The landlord, on the other hand, is not inexcusable, because the future occupier may not desire to consume gas; and even so—although such an idea would certainly appear to be against his character as a tenant—the gas company might have some valid objection to supply him.

That a large increase in the present consumption might be brought about by the adoption of gas as a ventilating and heating agent in our dwellings, there can be no manner of doubt; and that the education of the consumer in the most approved methods of using

what he has purchased would tend in this direction, is also beyond question.

Consumers really do not so much look to the price charged per 1000 cubic feet as to the *total* charge, in *comparison* with some previous period, and with the lights they know, or suppose that they have been using; consequently, an improvement, giving them something like the theoretical value of the light, would mean, practically, reduced price, and we all know that reduced price is the direct road to increased consumption.

Not only, therefore, is instruction for the consumer required, but there is also necessary some organization which would meet his wants, by the supply, for hire or otherwise, of the fittings which can be recommended to him as appropriate; so that what the landlord has neglected to furnish, and what the tenant might consider expensive in first cost, and afterwards cumbrous in removal, could be supplied to him without the expenditure of his capital, and afterwards remain for subsequent occupiers upon similar terms.

Treating simply of imparting such instruction to the consumer, no doubt the organization and scientific acumen of gas companies would be the most natural and easily available means to this end; but it is evident that, so far as the hire of appropriate fittings is concerned, the concluding clause of the last paragraph contemplates something beyond the restriction of the principle solely to cooking stoves, which is the limit hitherto of action in this direction, and it becomes necessary to inquire whether some other means may not more conveniently be employed, should extended operations of this kind be within the boundaries of reasonable contemplation.

The chief prerogative conferred by Parliament upon gas companies possessing statutory powers is the faculty of opening streets and highways for the purposes of laying or repairing their pipes. This, in fact, gives such company as possesses it (except where another company has equal rights over the same district) a virtual monopoly of the supply of gas within the defined area, as no company or individual may, without such power, open or otherwise interfere with public roads, without becoming liable to an indictment for nuisance. Parliament, however, while conferring such power, has invariably accompanied the favour by various restrictive enactments, amongst which, for present purposes, it is sufficient to mention those of dividends of late years limited to 7 per cent. per annum, and capital confined within expressly authorized limits. Now, it is obvious that, as for the purposes of hiring or selling cooking stoves, or other apparatus for consuming gas, it is quite unnecessary to possess parliamentary powers to open public highways, so is it obviously unnecessary, and indeed unfair, to employ in this way capital which, in consequence of these powers, is prohibited from earning more than a 7 per cent. per annum profit. No coercive measures on the part of companies towards consumers would be practicable, and, if they were so, it is improbable that Parliament would sanction them. The real influence would lie solely in the consumers conviction that the companies were honest and reliable advisers, and in the capacity of the companies, or of their authorized tradesmen, to furnish approved articles, for sale or hire, at prices which would compete with outsiders.

This being so, it is evident that, in selling appropriate fittings, or in letting them, fair trading profit may legitimately be earned, and that capital raised with the guarantee of a restrictive monopoly would be, to say the least, disadvantageously employed for such a business, when no monopoly could or would be enforced.

There are other practical difficulties, however, in the way of gas companies embarking, beyond the limit of the hire of cooking stoves, in this direction. Appliances such as have been suggested, for combining the heating and ventilation with the lighting of our dwellings, would require to be soundly and skilfully put together, and, were they to undertake this, gas companies would lay themselves open to serious responsibilities for default, an example of which is illustrated in the burning, some time ago, of the landing-stage at Liverpool. With the experience of such a disaster before them, the undertaking by themselves of any comprehensive measure which would thoroughly solve the difficulty is improbable, and, unless driven to devise unprecedented measures by some unwelcome inroad of electricity—looking to the difficulty of a satisfactory solution—possibly nothing beyond the present limit of progress may, for a considerable time to come, be attempted.

It is plain, however, that what the gas companies may not themselves do, without incurring risks beyond those contemplated in their charters, and also beyond the value of the remuneration they are authorized to earn, might properly be undertaken by what may be called auxiliary companies, working under the auspices of the gas companies, and who would be allowed to charge in accordance with the risks they undertook. To these auxiliaries, the gas companies would stand somewhat in the position which Parliament bears to themselves. It is true they could neither grant a monopoly of the trade, nor sanction coercive measures; but their moral support would be of considerable value, and in return they would be entitled to exact conditions which would ensure efficiency, and prevent overcharge. A tariff of prices might not, and probably would not, be possible; but if the company were registered, so that a published yearly or half-yearly balance-sheet became necessary, a stipulation might be made for a division of the profits beyond a maximum, somewhat after the manner of the arrangement between the Paris Gas Company and the Municipality of that city.

In this way, the consumer would be protected from excessive overcharge; and for such overcharge as, to provide an efficient guarantee against mishap, could not be avoided, and which, upon the year's working, experience should demonstrate, a moiety would indirectly return to his pocket through the gas company, who, not being allowed to declare beyond maximum dividends, would have to reduce the price of gas according to surplus profits realized. In this way, too, capital would be lucratively, and yet with fair security, employed by those who became partners or shareholders in such auxiliary companies; the consumer would derive benefit from additional comfort, and find a more convenient way of paying for his gas-fittings; and the gas companies would extend their trade, and, as a consequence, enhance the security of their investments.

Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

THE ELECTRIC LIGHT.

Sir,—Dr. Siemens's letter in *The Times* of the 13th inst. recalls to me the scene at the Society of Arts on the 4th, when a paper was read "On the Practical Application of Electricity to Lighting Purposes," where the lecture illustrated the light, but where the light—the Doctor's own lamp—failed to illustrate the lecture. The light was fitful in the extreme; and the gas light—a very effective sun-light—had every now and then to be brought to its aid. Of course, the usual apologies were forthcoming; but I, for one, did not go there to witness a failure—*that* can be seen elsewhere—but to be the spectator of an electrical triumph. If, with all the scientific and practical appliances at hand, we cannot yet—off-hand—after all the fuss that has been made about it, command an electric light sufficiently steady to stand out a two hours lecture and discussion, it is clear that the electricians have not yet "turned the flank" of the difficulty, and those Municipalities who are seriously contemplating the substitution of the electric light for gas had better "wait a little longer"—had better, at all events, wait till the Metropolitan Board of Works have tested it on the Thames Embankment, which they are preparing to do efficiently.

Dr. Tidy's letter in *The Times* of the 2nd ult. mooted a very important point, which I have seen only once noticed throughout these discussions—the "actinism" emanating from the electric light and from which gas light is believed to be almost free. What is "actinism," and what are its effects? It is that chemical principle of light which fades colours, bleaches linen, rots fabrics, tans the human skin, and puts out the fire! And all this it does by abstracting oxygen from the bodies it affects. Now, it will be essential that we ascertain, or approximately ascertain, before plunging head and heels into the electric light, how far it will act upon, and what effect it will have upon, our mental and bodily health. Who can say?

A writer has designated the electric light, somewhat hyperbolically, as the "poetry of chemistry and mortal decay." Dr. Tidy does not go that length; but he seems to be of opinion that the blue and violet rays—so often visible in the light, and of such intense chemical activity—are not only fatiguing, but hurtful to the eyes, with prospective advantage to the medical profession generally, and to ophthalmic surgeons particularly! To that opinion there has been no answer. Could we not have some independent and well-authenticated opinions from some of the most intelligent *employés* in the Magasins du Louvre—who have so long worked under the glare of the light—as to its effects upon them? Do not let us halt "between the hammer and the anvil," when the means are open to us of, in some measure, setting the matter at rest.

It seems now to be pretty nearly settled that it is the yellow ray in the gas that makes it agreeable; in fact, it is maintained that the yellow ray is a preservative of the eyesight. According to Dr. R. C. Croft, light passing through a blue medium has its "actinic," or chemical power, increased; whereas light passing through a yellow medium is deprived of its chemical properties, as photographers know. The Americans have made much ado about blue and yellow glass houses—considering the former useful and beneficial in cases where solar energy is desired, and the latter for invalids whose nervous condition may agree with less stimulating light.

There is one important point which I have not seen even hinted at anywhere; but I should like to know, and the public may wish to know, whether any danger is likely to arise from atmospheric electric discharges—sometimes very intense—being attracted to, and passing along the conductors. The telegraph wires, and those employed at them, were seriously subjected to such, until an expedient was contrived for removing the danger; for we know that the electric light is nothing more nor less than "condensed lightning," and in one case, in Paris, the operator had brought the current of electricity upon himself, and had the bone of his arm shivered up to the elbow.

There is another point—and a very important one for London—which has not yet had an answer. A Mr. Hedges, in *The Times* of Oct. 12. stated that when the electric light was tried along with a gas-jet at the Westminster clock tower, *the electric was not visible in a haze*, the gas-jet being the only light visible. If this is true, and gas abolished, we may have the pleasure of seeing the link boys in full force again during our November fogs.

I notice that the electric light is about to be tried at some of our railway stations. In its present stage it is a somewhat hazardous experiment; more especially if the abolition of gas lights is seriously contemplated. For if a driving-strap break, as at St. George's Hall, Liverpool, lately; or a stoker fall asleep, as occurred at the South Foreland Lighthouse; or a carbon break and drop, as in another case, and the station be left in darkness as a passenger train is arriving, who is to be liable for the consequences? The days of irresponsibility are, for the present, at an end; and the public are not likely, for some time to come, to be in a mood to temper justice with mercy where a director is the delinquent.

At the present critical moment, when the electric light is being put upon its trial, we may be sure that it is being manipulated with all the care, delicacy, ingenuity, and practical skill within the command of the promoters of it; for they have to "educate" the general public, and to conciliate and win over that victim of every plausible crotchet—such as the education craze, which is now running its course—the *taxpayer*; and to get him on the side of those who have the lightning in their pockets for sale! But once in the hands of the public—entrusted to the rough-and-ready management of every-day workmen and servants—

blunderings, clumsy mistakes, shortcomings, and accidents will be the order of the day.

If the condition of *our* gas be a reason for adopting the electric light, how much more forcibly must it apply to Paris, where the gas is supposed to have 25 per cent. lower power than in London; yet, as we have seen, the Municipality refused to renew their contract with the Electricity Company, except at a sacrifice to the Company; and, after all, only for a few months.

The electric light may prove a scientific light, or a light of luxury; but it will be found, when the present excitement is over, that gas will remain the light of the million.

We are daily being furnished with the names of places where the electric light is being *set up*. It would be a satisfaction to the public to know at how many places it has been tried and *given up*. That information would help us to a calmer and sounder judgment on the subject. So far, I could name a few. But there are others infinitely better able to furnish data than I can possibly be.

The public seem marvellously ignorant regarding the history of the electric light. Most people—particularly nervous gas shareholders—believe it to be the diabolical invention of yesterday! This is not surprising, so much has been said and written about it these few months past. It puts one in mind of the story of the Scotchman who talked so much about what he had accomplished by the sweat of his brow, that his neighbours began to believe that he had invented the sweat of his brow! Why, Sir Humphry Davy exhibited a brilliant electric light, at his lectures, more than 50 years ago. The electric light was used with great effect so far back as 1846, in the sunrise scene of "Le Prophète," at the Grand Opera House in Paris; and it has been employed for night-work, and in other ways, for more than 20 years; and Holmes made electric machines so far back as 1849, and some of them are still in use, or were recently, in the South Foreland Lighthouse. But, undoubtedly, very considerable improvements, since then, have been made in the instruments and machinery for developing the electric light. Hence the intense practical interest now centred in it.

I do not venture to trouble you now with any comments on the numerous other heads of this question. They have been fully and very variously discussed of late, both in your JOURNAL and otherwise, and may be left over till after the Metropolitan Board of Works and the City Corporation have made the authorized experiments on the Thames Embankment, on the Holborn Viaduct, and at the Mansion House, under the surveillance and superintendence of their very able Engineers and Surveyors.

I think it would be interesting to the public, and I am sure it would be instructive as well as interesting to the Shareholders in Gas Companies, were the Directors, at their next half-yearly meetings, to give us a *videmus* of the changes this year in the holdings of their Shareholders, with the salient characteristics of these changes.

18, *Old Broad Street, Dec.* 16, 1878. WILL. SCOTT.

Legal Intelligence.

READING COUNTY COURT.—THURSDAY, DEC. 12.

(*Before Mr.* VERNON LUSHINGTON, *Q.C., Judge.*)

PROCEEDINGS UNDER THE RIVERS POLLUTION ACT.

An action under this statute was brought by the Guardians of the Hartley Wintney Union against the Governor of the Royal Military College and Staff College, Sandhurst, to restrain him from allowing sewage to run into and thereby pollute a stream called the Blackwater.

Mr. CHANDLER, Clerk to the Hartley Wintney Board of Guardians, appeared for the plaintiffs; and Mr. WITHERINGTON represented the defendant.

Mr. CHANDLER said his application was made under the Rivers Pollution Prevention Act, 1876, to restrain the defendant, General Napier, from allowing sewage to flow into the River Blackwater from the Military College. The nuisance was existing a day or two previously, and he now asked his Honour to grant an order for the abatement of it.

The JUDGE asked under what section of the Act he was empowered to deal with the case.

The section having been read,

Mr. WITHERINGTON said he did not see how an order could be made. General Napier was a servant of the Crown, and therefore, he submitted, could not be liable.

Mr. CHANDLER contended that the defendant, being the occupier, was the proper person to sue.

The JUDGE said that, according to judicial legislation lately, the servants of the Crown were liable, as occupiers, and in many actions they had been the defendants. It would be the wisest course to take evidence that day, but he should certainly reserve his decision.

Dr. *C. J. Denny*, Medical Officer of Health for the Hartley Wintney Rural Sanitary Authority, stated that he was directed by the Authority to make inspections of the stream, and accordingly on Feb. 13, May 20, July 22, and Dec. 6 and 10, he visited it, and found that the sewage from the Royal Military College was flowing into it through a large pipe. He took samples of the liquid, and it consisted of noxious matter. He found the same state of things on each of the days he visited the stream.

Samples were produced.

Cross-examined: There were filtration works belonging to the College, between 100 and 200 yards from the stream. The sewage passed into the stream without being filtered, the filters being insufficient.

By the JUDGE: If the filter-beds were made efficient, it would be a great deal better.

Mr. *J. Monk*, the late Clerk to the Guardians, produced the minute-book, in which it stated that proceedings were ordered to be taken against the Authorities of the College, in respect to sewage being emptied into the stream.

Mr. WITHERINGTON said that the minute in itself gave no authority whatever to the Officers of the Union to take proceedings against the Governor of the College.

The JUDGE: I shall not take any notice of that objection.

Mr. WITHERINGTON: The notice should have been addressed to the General by name.

The JUDGE said he could not understand how persons in the high position of the defendant should take such technical objections as had been raised. The Guardians had a duty to perform, and he considered the objections miserable. He would take a note of the objections, and would reserve his decision.

BIRKENHEAD POLICE COURT.—THURSDAY, DEC. 19.

(*Before Messrs.* J. R. SHAW, O. N. SHAW, *and* LEE.)

CONVICTIONS FOR WASTING WATER.

A number of persons were summoned for having wasted water belonging to the Wirral Water-Works Company.

Mr. PUGH, who appeared for the Company, said that the Directors had recently had their attention forcibly directed to the circumstance that the consumption of water per head of the population supplied was larger than that of any other company in the kingdom. They had for some time been endeavouring to reduce the quantity supplied to certain districts. Their men had regularly kept up an inspection of taps and closets inside the houses during the hours allowed by the Water-Works Clauses Act, 1847; but, although much waste had been detected, and the usual notices served upon the defaulters, very little perceptible difference had been made in the quantity of water delivered. Two months ago, however, the Secretary of the Company, acting upon instructions from the Directors, measured the quantity of water taken from the reservoir between ten o'clock at night and four o'clock in the morning, and, after repeated tests, it was ascertained that a great waste of water was going on at night. As the mains were found to be in perfect condition, it only remained for the officers of the Company to trace the waste to the houses in which it was going on. During last week the Secretary and Inspectors examined in the night-time the whole of the branch-pipes from the mains, and, detecting, by hearing the rush of water, in what directions the waste was taking place, had the water turned off. Early in the morning, the water being again turned on, they visited various houses, and found a number of cases of waste, owing to taps or closets being out of repair, or closet-valves being allowed to run for the purpose of flushing closet-pipes. He added that the extreme penalty for the offence with which the defendants were charged was £5. He also pointed to the great loss which the Company had sustained, and asked for the infliction of heavy fines.

The various cases were then gone into, evidence being given for the prosecution by Mr. George Miller, the Company's Secretary, and by two Inspectors.

The first case was that of John Kellett, of Mersey Lodge, New Ferry Lane, the evidence against whom showed that the handle of the closet-tap was found kept up by a hammer, causing a great waste of water, and that the defendant told the Secretary this was frequently done at night in order to flush the closet drain. The defendant said he was not in the habit of running the tap in question all night; but as there was a bedroom about three feet from the closet, it was necessary at times to do something to get rid of the bad smell.

Mr. J. R. SHAW: Suppose all the houses in the district were to do this? Why the Mersey would not be enough for them. The defendant will have to pay 15s., and costs.

The second case was one in which W. G. Johnson, of 1, Weston Terrace, New Ferry Lane, was charged with a similar offence, it being stated that waste of water had been caused through the propping up of the handle of the defendant's closet. The defendant's wife indignantly denied the charge; but the Magistrates considered the case proved, and inflicted a fine of 15s., and costs.

Other cases were against Ann Wheeler, of Woodhey, and against R. M. Townsend, of Higher Bebington, who were each ordered to pay costs, on informations charging them with having wasted the Company's water.

An information against Henry Blagg, of Hillman Terrace, Brownlow Road, New Ferry, was dismissed.

ILLEGALLY TAKING WATER AT DERBY.—Last Thursday, at the Derby Police Court, Ann Princep was charged by the Derby Water-Works Company that she did unlawfully take water belonging to them, and for which she had no agreement to take, on Monday, 9th of December. She was fined 10s., and costs, or 14 days' hard labour.

PRODUCTS OF COMBUSTION IN THE ELECTRIC ARC.—Mr. Thomas Wills, F.C.S., has been making some experiments on the production of oxides of nitrogen in the electric arc. The atmosphere, of course, consists mainly of oxygen and nitrogen, but simply in a state of mechanical mixture; if these gases become chemically combined, they form several oxides of nitrogen, most of which are strong and corrosive acids. At a high temperature small quantities of these gases can be made to unite. This is the case when electric sparks are passed through air; also during the combustion in air of a very hot flame, such as that of hydrogen. It, therefore, seemed probable that, as the temperature of the electric arc is undoubtedly very high, nitric acid, or some other oxide of nitrogen, might be produced by the electric light. The first experiment was rather surprising. A glass cylinder placed over an electric lamp (Foucault's regulator) for two minutes, and afterwards examined, was seen to contain a perceptible amount of red fumes, due to peroxide of nitrogen ($N_2 O_4$). The air surrounding the lamp was next drawn through a solution of potash, and the amount of nitric acid estimated. This gave ten to twelve grains of nitric acid produced per hour—it may eventually prove to be more, the difficulty being to collect the whole of it. The next step in the research will be to examine the various forms of electric light, with a view to determine the amount of nitric acid produced by each. The subject formed the basis of a communication to the Chemical Society last Thursday evening.

PRESTON WATER SUPPLY.—The works which have for the last three years been constructing, in order to afford a sufficient supply of water to the higher parts of Preston, have quite recently been completed. The Engineers of this scheme were Messrs. Brierley and Holt, of Preston, who, soon after the Corporation became owners of the water undertaking in 1875, were instructed to devise and carry out the works for the high-level district on the north side of the borough, and which attains an elevation of upwards of 700 feet above mean sea level. The inhabitants have hitherto had to depend for water upon pumps and springs, and for many years past this has been a source of constant complaint. It was found impossible to reach the elevation by any gravitation scheme, and, accordingly, a shaft and bore-hole were commenced. The shaft was 10 feet in diameter, lined with brickwork in Portland cement, and was sunk to a depth of 31 feet. From the bottom of the well a bore-hole was made through the rock, which is millstone grit, to a depth, including the shaft, of about 215 feet from the surface. The bore-hole is of the clear diameter of 1 foot 9 inches. By boring at this place water was found, and it was soon evident that there was water enough to supply the whole district most abundantly. A covered reservoir was erected at the highest point of the Corporation Park, at an elevation of about 720 feet above mean sea level. It is formed of concrete and brickwork, and has a capacity of 750,000 gallons. It is covered over with arching in brickwork carried on a series of iron columns and girders. The height from the bore-hole to the surface water in the reservoir is 320 feet, and the water is now being lifted to this elevation along a line of 9-inch iron pipes laid from the well to the reservoir. There is already sufficient water in the reservoir to ensure to the district a good supply for several weeks.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

Dr. Whitmore's report on the illuminating power, pressure, and quality of the coal gas consumed during November, in the parish of Marylebone, and supplied by The Gaslight and Coke Company:—

November.	Illuminating Power in Sperm Candles.			Mean Pressure in Tenths of an Inch.		Mean Quanty. of Sulphur in 100 Cu. Ft.	Mean Quanty. of Ammon. in 100 Cu. Ft.	Sulphuretted Hydrogen
	*Mean of 25 Obser.	Highest.	Lowest.	Highest.	Lowest.	Grains.	Grains.	
Gas supplied from the Fulham works . .	16·73	17·31	15·84	24·70	9·88	15·06	0·60	No trace
Gas supplied from the Beckton and Bow works	16·86	17·24	16·31	32·27	15·66	14·00	0·33	No trace
Cannel gas supplied from the Pimlico works	21·34	22·74	20·42	21·45	12·56	18·93	0·83	No trace

Mean of daily readings of barometer . . . 29·51
" " " thermometer . . . 58·91

* Each observation consists of ten readings of the photometer, at intervals of one minute.

The mean illuminating power of all the gases supplied to the parish during the month was well over the standard. The supply from the Fulham works was six times over 17 candles, that from Beckton and Bow was eight times over 17 candles, whilst the cannel gas was five times over 22 candles. The mean amount of sulphur found in 100 cubic feet of the Fulham gas was 15 grains, in the Beckton gas it was 14 grains, and in the cannel gas 19 grains. The mean quantity of ammonia in all was considerably less than one grain. The pressure of all the gases was satisfactory, and on no occasion was sulphuretted hydrogen detected in either of them by the ordinary tests.

METROPOLIS WATER SUPPLY.

Dr. Whitmore's report on the composition of Thames Companies and other waters used in Marylebone during November:—

November.	In Grains, per Gallon.			In Parts, per Million.		In Degrees.	
	Total Solid Matter.	Loss by Incineration.*	Chlorine.	Free Ammonia.	Albumenoid Ammonia.	Hardness.	Hardness after boiling Fifteen Minutes.
West Middlesex	20·08	0·94	1·10	0·02	0·08	13·8	3·2
Grand Junction	19·98	0·96	1·14	0·01	0·09	13·7	3·4
River Thames at Hampton.	21·84	1·40	1·30	0·07	0·21	14·8	3·5

* The loss by incineration represents the amount of organic and other volatile matters contained in the Imperial gallon (70,000 grains) of water. The total solid matter, *minus* such loss, consisted chiefly of carbonate of lime, with small quantities of other equally harmless salts.

The water, as taken from the mains of both Companies, was perfectly clear and bright. The great advantage of filtration is very conspicuous this month, as shown in the greatly reduced amount of albumenoid ammonia contained in the water drawn from the Companies mains, as compared with that taken from the River Thames at Hampton.

Lieut.-Col. Bolton reports that the state of the water in the Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated), was indifferent and turbid from the 1st of November to the 5th; it then became clearer, and was in a good condition until the 11th, after which it again became turbid, and continued in a bad state during the remainder of the month. The highest flood state of the river at Molesey during the month was 3 feet 3 inches, and the lowest 4 inches above the summer level. The rainfall, as taken at the Chelsea works, was 3·03 inches in November. The water in the River Lea was generally turbid during the month.

CONTINENTAL UNION GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held at the Offices, 7, Drapers Gardens, Throgmorton Street, on Tuesday, the 17th inst.—Henry M'Lauchlan Backler, Esq., in the chair.

The Secretary (Mr. H. John) read the notice convening the meeting, and the following report of the Directors:—

The Board of Directors have the pleasure to lay before you a brief account of the works carried out in the Company's stations during the year ending June 30, 1878, and of the principal facts connected with that year's operations.

The details of the works will be found in the report of the *Union des Gaz*, now lying on the table, and it will be sufficient to refer here to the most important.

At Genoa a new purifier-house and additional purifiers, at Nimes and Strasburg new purifiers, and in all the Company's stations extensions of mains and additional public lamps, rendered necessary by the continually growing consumption.

Compared with the previous twelve months, the sales of gas have increased by 21,977,190 cubic feet, or 3 per cent.; the registered number of private lights shows an addition of 13,216, and 491 new public lamps have been erected.

The manufacture of gas, compared with the results of 1877, which the Directors had reason to consider satisfactory, affords evidence of further improvement in every department, and the coals carbonized show a diminished cost of about 5d. per ton.

The wear and tear at all the stations is less in amount, and the expense of purifying is also reduced by means of the use of oxide of iron in combination with lime, which is now more generally adopted, and better understood by the Superintendents, than formerly.

An increased profit has likewise been realized on the ammoniacal residues and tar.

At the general meeting held in December, 1877, the Directors alluded to the depreciation in the value of coke. This, they regret to say, has continued, and somewhat increased, chiefly at the Italian stations, and the Company's revenue has thereby been reduced to the extent of £5200. Since the termination of the last financial year more encouraging returns have been received, and the Board have reason to believe that during the first half of 1879 this drawback will be materially modified. Favourable contracts have been entered into, by which all the coke that can be produced at the Italian stations during 1879 is disposed of, and satisfactory arrangements have also been made under which the coal required during next year will be supplied at a lower cost.

The accounts laid on the table show that the profits for the twelve months have increased from £54,376 to £54,729. An interim dividend of 2½ per cent. having been paid on the 1st of July, the Directors now propose to declare a further dividend of 4 per cent., which, after allowing for the preferential charges, will permit them to carry forward to the new account the sum of £4832.

The retiring Director is Henry Solomon, Esq., who, being eligible for re-election, offers himself accordingly.

The retiring Auditors are Alfred Hersee, Esq., and Frederic Tendron, Esq., who, being eligible for re-election, offer themselves accordingly.

The Chairman: Gentlemen, I think the report just read is brief enough to satisfy those Shareholders who complained, on a former occasion, that they found it difficult to follow numerous details and figures, when read at a meeting like this. But, if this report be wanting in length, it contains in pith all that we can communicate to you. If you wish to enter more fully into particulars, you are at liberty to do so by looking in here, at any time, when the report of the *Union des Gaz* may be seen and explained; and I feel confident that that may be done to the applicant's entire satisfaction. To save some of you that trouble, however, I will just supplement our own report by a few remarks. As the Shareholders who attend these meetings are not always the same, but vary according to the transfer of shares that may be effected in the course of a year, it may not be amiss to remind you of the nature of our relation to the *Union des Gaz*. That Company is an old-established one, having thirteen stations in France, Italy, and Alsace, the lease of which was taken over by this Company at its formation fourteen years ago. But we soon found that it did not suit us to remain mere leaseholders of the works, with the prospect of having to relinquish the management in 1883. Having expended a large amount of capital on the improvement and extension of the different establishments, we desired to exercise a corresponding right of proprietorship, and to retain the management permanently in our hands, whilst preserving intact the form and constitution of the *Union des Gaz*, which could not be altered without the risk of interference from third parties. Our object was accomplished by obtaining 40,000 shares at par to represent the outlay of this Company, and we thereby became proprietors of four-fifths of the total number of shares in the *Union des Gaz*, with voting powers in proportion, all the Directors of this Company being also Directors of that one; so that, whilst the two remain thoroughly separate and distinct according to law—one being a French *société anonyme*, and the other an English joint-stock company—for all practical purposes the management remains identical. At the same time we have this great advantage over any other gas company—that, instead of all our capital being locked up in undertakings not easily saleable, it is really, so far as the *Union des Gaz* stations are concerned, invested in convertible securities, of which any portion, from £20 upwards to £800,000, may be sold whenever we think fit to do so, at the market value of the day, whatever that may be, either in France or England. It is available in this shape if we elect to pay off our debentures instead of renewing them as they fall due, or even if we desire at a future time to pay off part of our share capital in the Continental Union Gas Company. I need hardly say that we have no wish to do so at present. We value too highly our investment in the *Union des Gaz* to part with any portion of it lightly. It stands at present at a good premium, and we hope to see it improve gradually in the future. I have again called your attention to the facts of the case, so that new comers in the undertaking may be made aware of the highly satisfactory position in which we stand, and that the memory of others may be refreshed on the subject. Having relieved my mind of this statement, I will advert for a moment to the working of the past financial year, which, notwithstanding the exceptional dulness of trade, shows an improvement on the results of the previous twelve months. According to the terms of several of our concessions, or to meet the pressure of the times, we have reduced the price of gas in some cases, and the consequence is, that although the quantity sold is 3 per cent. more than last year, the rental realized is only 1½ per cent. in excess. I am glad to be able to say that that rental was collected as closely as possible month by month, and that the bad debts amounted to £439 only, on a total sum receivable of over £250,000. Our carbonizing was, as you will have observed, satisfactory, and, in fact, we are never completely satisfied unless we manage to effect some little improvement every year. The leakage or gas unaccounted for is also better, and the loss on exchange has not been greater in the aggregate, although rates continued high throughout the year. We have saved about £2000 in the cost of coals, but lost over £5000 in the reduced value of coke. This is, I believe, the only dark spot on the picture placed before you; but we have some reason to hope that it will be effaced during the coming year, there being now a ready sale for coke, especially in Italy. As regards coals, we know that we shall effect no inconsiderable saving during the current year. The state of the accounts of the *Union des Gaz* would have admitted of a larger dividend than that recently declared on the shares in that undertaking, and consequently of a heavier balance available for dividend in the Continental Union Company; but it was thought that, under present circumstances, it would be quite satisfactory to all parties to maintain the rate of the previous year, and make provision for the future by carrying over a large balance, after setting aside all customary reserves with an unsparing hand. At the same time I may state that the prospects of doing an increased business are most encouraging, and we are adopting energetic measures to induce a more general use of gas by all classes, and for various purposes, wherever it is prudent to offer additional facilities for the attainment of that object. I suppose it is expected, before I move the adoption of the report, that I shall say something on that fearful and wonderful subject, the electric light; but I have heard it said that the opinion of any one so deeply interested as I am in the welfare of gas companies must necessarily be biassed against that light. This may be the case; but even if it be true, it is equally so that the opinion of an electrician, and especially of any inventor of electric lighting, is as little worth having in favour of his own hobby, as that of a gas director against it. The best way is for people to judge for themselves. There is now plenty of literature on both sides of the question, to enable any one to form an independent opinion. I have performed my part, and my nerves not having been affected by any foolish panics and scares, I have done my best to strengthen those of such of my fellow-Shareholders as were less fortunate than myself, and, I hope, not without success. I am ready to admit that a man's interests may influence his judgment, but every one must allow that the opinion of any man in favour of an adversary or competitor is really evidence of sterling value. With this impression strong on my mind, I attended, as a member, a meeting held the week before last by the Society of Arts. It had been announced by the public Press that at this meeting a paper "On the Practical Application of Electricity to Lighting Purposes" was to be read by a well-known engineer, and a sort of competitive exhibition held of the different systems of electric lighting now before the public. The paper was, no doubt, highly interesting to such among the audience as were not already acquainted with the particulars of which it formed an epitome. But the exhibition of the lights was a conspicuous failure, even in the very presence of all the electric talents of the day. It flickered and spluttered, and noisily asserted itself in the way in which electric lights are wont to behave, and on two distinct occasions a total eclipse occurred, so that the gas had to be turned on as a substitute. The Jablochkoff system, now being tried as an experiment on the Thames Embankment and Holborn Viaduct, was decidedly condemned by the lecturer on account of its excessive cost. One of the most ardent electricians present innocently and honestly admitted that he abstained from showing his particular pet patent in action, because he was apprehensive that it also might prove a failure. He said, moreover, that he did not believe electricity would take the place of gas for domestic purposes during this century. The Chairman of the meeting, Dr. Siemens, expressed a similar opinion, stating that he had heard a great deal about inventions for subdividing an electric current indefinitely, but he did not attach much importance to that, as the electric light would not take the place of gas

for our streets or in our houses. Mr. Preece, the Post-Office Telegraph Engineer, spoke with authority, as a thoroughly independent man. He said he belonged to a large establishment, where the gas bill came to thousands of pounds a year, so that it was a matter of extreme urgency to them to find a light superior to that now in use; but he looked upon the subdivision of the electric light as a practical impossibility. He said he knew Mr. Edison, and had seen his laboratory; that he was an extremely ingenious man, but that his ingenuity often carried him to extremes. Mr. Edison was an American of the Americans. He had taken out 269 patents, but he (Mr. Preece) only knew of three that were at work. He feared that Mr. Edison had tumbled into a tremendous mare's nest. This reliable opinion of Mr. Preece seems to be held pretty generally, and the public have become so well aware that much which has appeared in American and English newspapers, regarding the general applicability of the electric light, is mere nonsense, that the market value of gas shares is now but little affected by the transparent attempts of some journalists to cause a renewal of the scare. The more marvellous the statement, the less effect it is likely to produce. In fact, the public have had a surfeit of absurdities. The best course we can adopt is to leave the numerous inventors to fight out their rights and wrongs amongst themselves, whilst we await the survival of the fittest. Let them have the shells, we will keep the oyster. Many people reason as if electricity had secured a monopoly of science; but I am not aware that any patent has yet been taken out to that effect, and I do know that science is actually siding, and will continue to aid, gas, to hold its own against all comers. I shall be glad to hear any further remarks on this or any other subject interesting to us, and to answer, so far as I am able, any specific question on the business of the Company. I now beg to move that the report and accounts be received and adopted.

Mr. BLAKE seconded the motion.

A SHAREHOLDER asked the Chairman if he had seen the electric light at Messrs. Shoolbred's.

The CHAIRMAN said he had seen the light at Messrs. Shoolbred's, and also at the Magasins du Louvre. Probably Messrs. Shoolbred found it a capital advertisement, and it was perhaps with that object that they had introduced it into their establishment regardless of cost.

Mr. F. E. SMITH said that the Shareholders ought to be thankful to the Chairman for his clear statement as to the electric light, and for the pamphlet he had sent them on that subject. He knew of no company that was better managed than the Continental Union Gas Company; and it was satisfactory to know that the men at the head of it held a large amount of the Company's stock, and knew well what they were about. The Chairman had had great experience in connection with gas, and was always ready to pay attention to anything that would serve the interests of the Shareholders. With regard to the electric light, he thought that it came very far short of what the public would require. Except for the purposes of street-lighting, he thought it would prove a nine-days wonder, and that the shareholders of gas companies had nothing to fear from it. The Gas Company in Sheffield, which were working very successfully, and paying 10 per cent. to all classes of Shareholders, had declared themselves ready to adopt the electric light, if it should prove to be serviceable, but they did not expect to be called upon to do so. He had seen the light in Paris. People there were very dubious about it, for sometimes it went out suddenly, and they had to fall back upon gas. In some places where it had been tried it had lately been abandoned. The light had been used at the Birmingham Dog Show; but gas-jets were placed all round the building, lest the electric light should go out and leave the people in perfect darkness. He observed that some of the lights emitted very offensive sparks, which, in private houses, would be the subject of bitter complaint. They all knew what the cost of gas was, but the cost of the electric light was not known. At Sheffield, gas could be sold for 2s. 3d. per 1000 cubic feet, and in London for 3s. 6d. per 1000; but he did not think that the electric light could be produced for twice that sum. He could not account for the scare among the public in regard to gas shares. The Continental Union Gas Company's shares had gone down from 23 to 15½. He was one of the largest Shareholders in the Company; for, notwithstanding the electric light, he had increased his holding instead of selling out. He believed it was wise to take advantage of other people's fright, for he believed that the shares would rise to their former value. He was glad to find that the profits were increasing, notwithstanding the prevailing depression. That, of itself, showed that the affairs of the Company were well and judiciously managed.

Mr. BOWRING said that, as an original Shareholder, he had the means of knowing the manner in which the Company had been conducted, and the confidence he had always felt in the management remained unchanged. It was of no use, however, to shut their eyes to what was passing around them. He agreed with what had been said as to the electric light, but, though it was still in its infancy, it might be like an infant giant. It was not wise, because the experiments had not been entirely successful, to take it for granted that the system had attained its full development. There was no need, however, for alarm. He should not sell a single gas share, but would rather go in the opposite direction. Some interesting experiments were being tried at the Royal Albert Hall, with which he was connected; and the assistance of Dr. Siemens and Professor Tyndall had been obtained. If those experiments were successful, the electric light would, no doubt, be used for theatres and other places of public resort, and would prove a formidable competitor with gas. But he did not think there was the least chance of gas being superseded so long as it had the power of heating, which the electric light had not. He wished to ask for an explanation of the apparent anomaly of there being a gain of £2000 upon coals and a loss of £5000 upon coke, as he had always thought that the two things went together. He also wished to suggest that the report and accounts should be circulated among the Shareholders a few days before the meeting. There was nothing to conceal, as there had been in many joint-stock companies; and even in the case of all well-managed concerns like their own, they should be made public, except, of course, in regard to matters in which secrecy was imperatively required.

Mr. BADDELEY said, if it were true that electric lighting was in its infancy, it was no less true that the history of gas had yet to be written. He believed there was a field for the operations of both. Electricity might be useful for lighting a large building like the Royal Albert Hall, but he could never have confidence in it until the gas was cut off from the buildings to which electricity was applied. At the meeting at the Society of Arts, the noise made by the electric light was so great, that, while the paper was being read, a unanimous desire was expressed by the audience that it might be put out, in order to enable them to hear the lecturer. If that state of things continued, the less of electric lighting they had for private purposes the better. He was glad to find that the late scare had not greatly affected the Continental Union Gas Company. The amount paid for transfer fees last year was £54, while this year it was only £36 12s. 6d. He believed that there had been 139 fewer shares transferred this year than last. He was surprised that advantage of the late fog had not been taken by the Corporation and the Board of Works, to light up the London streets by electricity. If they had ordered a fog for the occasion, they could not have had a better one; but they must bear in mind that, in such a case, it would require two hours to get up the steam to work the engine and machine, and by that time probably the fog would be over.

The CHAIRMAN said the accounts that had been given of the cost of the electric light were not trustworthy, and it was really impossible to say what was the expense its production entailed. All that was positively known was that the City of Paris had paid for the electric light a certain sum, which was understood to be below its cost; and that it had only been continued from the 30th of November to the 15th of January on the understanding that one-ninth of that sum would be accepted by the Société Générale d'Electricité in order that they might not lose the *prestige* they had acquired by the lighting of the Avenue de l'Opéra and other places. It was clear they must be heavy losers, and if they continued to make losing contracts, in Paris or London, there would soon be an end of their operations. He had been informed that the shares of that company, which a short time ago fetched 800 or 900 francs, were now below the par of 500 francs. With regard to the depreciation of the Continental Union shares in the market, that was a matter into which the Directors could not enter. All they had to do was to attend steadily to the business of the Company, occupying themselves as little as possible with such extraneous matters as the price of shares. No doubt it was very vexing, especially to large holders, to find that the value of their property had been heavily depreciated by the folly of some of their fellow-Shareholders, who had, in alarm, run into the market to sell at any price. With reference to the difference between the cost of coals and the loss on coke, that might be accounted for by the fact that the benefit arising from the low price of coals had been obtained during the preceding year—a period which did not tally exactly with that during which the loss from the sale of coke arose. They were now on the way to recoup the loss. Coke was selling readily in Italy, and he hoped that there would be a better average price than that of last year. With regard to the question of the distribution of the report amongst the Shareholders, it should be remembered that there might be persons hostile to them in the different Municipalities with which they had very close and delicate negotiations to conduct. The Directors had so far given way to the Shareholders as to send them a printed report after the meeting had taken place, and that, after discussion on several occasions, had been considered sufficient for their information, while it in some measure guarded the Company. He did not say that even that might not injure them at times, because they were not a Company dealing with English interests entirely; there was occasionally a national feeling against them, and that feeling was sometimes very strong indeed. If hostile persons were to get a copy of the report before the meeting, they might attend and make speeches which would be detrimental to the interests of the Company. Of course, they had no improper motives of secrecy. Everything they did was open to the light of day; and if they appeared to be at all reticent, it was only out of due consideration for the true interests of the Shareholders. With reference to the lighting of public buildings by electricity, he thought it was very likely that that would take place. He had recently seen the effect of the light at the Hippodrome in Paris. He did not know the cost, but he should judge that it was very considerable. There were 80 lights, and with such a number it was probable that the illumination would be effective, because it did not much matter if half a dozen of them failed. He had observed that many of the lights went out during the evening, but they were quickly re-lighted. He also saw the light at a large theatre, but in that instance there were only four electric lamps in the upper part of the building, the rest of the house being lighted by gas. In very large buildings the system might perhaps be effectual; but he did not think it could be successfully adopted for small structures. He had no apprehension with regard to domestic lighting. Not even Mr. Edison had pretended to carry out electric lighting without the aid of an engine of some sort, and in a large city such engines would have to be repeated almost indefinitely. He had, in a pamphlet, pointed out the practical inconveniences of the system, and he had not seen any of his objections removed. The changes in the proprietary of the Company had not been numerous. Up to the 30th of June last the transfers had been comparatively few, but they had somewhat increased since the alarm that had taken place. After all, the persons who sold out in that way were perhaps best out of the Company, because they were only a source of uneasiness to their fellow-Shareholders, as every newspaper article, with regard to electric lighting, caused them to rush into the market and sell their shares.

The motion for the adoption of the report was then put and carried.

The retiring Director and Auditors were then severally re-elected.

Mr. TENDRON, in acknowledging his re-election as one of the Auditors, said that the proprietors might rest assured that the accounts were thoroughly investigated.

Mr. STOKES moved a vote of thanks to the Board of Directors for their management of the Company's affairs.

The motion was unanimously adopted.

The CHAIRMAN, in acknowledging the vote of thanks, said he hoped the Company would be able to develop a new business in a field that had not been hitherto fully cultivated—namely, the supply of gas for heating, cooking, and the production of motive power.

The proceedings then terminated.

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Office, Commercial Road, Pimlico, on Thursday, the 19th inst.—JOHN DEEDES, Esq. (the Governor), in the chair.

The SECRETARY (Mr. A. Gill) having read the advertisement convening the meeting, and the seal having been fixed to the register of proprietors, he proceeded to read the reports of the Government Auditors and the Auditors of the Company. The following report and statement of accounts were then taken as read:—

The Company's accounts for the half year up to Sept. 30, 1878, as examined and certified by the Auditor appointed by the Board of Trade and by the Company's Auditors, are submitted to the proprietors herewith.

It will be seen that the revenue from water-rents amounted in the half year to £48,676 4s. 3d., being an increase of £1361 8s. 5d. as compared with the rental of the corresponding period of last year, and that the cost of maintenance and management amounted to £17,833 8s., being £1854 6s. 10d. in excess of the expenditure in the corresponding period last year. The excess is due chiefly to the maintenance of the new works and pumping establishment at Molesey, and to increased law and parliamentary charges.

The capital account shows a further expenditure of £6838 2s. 1d., and a credit balance of £20,137 12s. 1d. at the date of the account. The account includes the payment of all contractors claims in respect of the Molesey works. The Directors consider that the whole of these works have been ably designed and carried out, and are producing very satisfactory results, and the Government Water Examiner, in his monthly returns, has continued to report favourably on the quality of the water since they were brought into complete use a year ago.

During the half year, 1872 yards of service-pipes have been laid for ordinary extensions in the district. 65 houses have been pulled down for improvements, and 208 new supplies have been laid on, representing a future annual income estimated at £850.

A contract has been entered into for providing and laying an auxiliary supply-main from Stamford Bridge, Fulham, to Ebury Bridge, Pimlico. By means of this main an additional quantity of water will be admitted into the centre of the district, and the pressure in the other mains will be further increased.

The water pumped during the half year was 1602 million gallons. It is supplied on

constant service to all houses built and building on the several new estates in course of formation in different parts of the Company's district.

The older portions of the pumping machinery at Surbiton, which have been in constant action for upwards of 20 years, and the face of the river wall, have been subjected to careful examination, and all needful restorations are now being effected. The aqueduct over the Thames at Fulham has been examined, and the whole of the timber and brickwork substantially repaired. The Engineers report that the rest of the Company's property is in excellent order.

The Act for conferring further powers on the Thames Conservancy received the Royal Assent in August last. It enlarges the powers of the Conservators as regards the prevention of the pollution of the river and its tributaries. It permits the Companies to supply water to one another, and it imposes on each of the Thames Companies the contribution of a further annual payment of £1000 in aid of their general expenditure.

Two Bills which were introduced last session into Parliament by the Metropolitan Board of Works, with the object of acquiring control over the London Water Supply, were both withdrawn. The Company were put to considerable expense in collecting evidence in support of their interests. The Directors observe that it is the intention of the Board again to apply to Parliament for a similar purpose in the ensuing session, provided they are able to obtain the support of the Government.

The Directors recommend that a dividend for the half year at the rate of 6 per cent. per annum be declared on the ordinary stock, and paid on the 4th of January next, to the several persons who are, on this day, proprietors of such ordinary stock.

Dr.—REVENUE ACCOUNT, FOR THE HALF YEAR ENDING SEPT. 30, 1878.

Maintenance.			
To Maintenance and repair of impounding and service reservoirs, filtering-beds, works, and pipes, or for obtaining and storing of water, including the cost of materials and labour	£731 18 7		
Maintenance and repair of mains, pipes, fittings, meters, and works connected with the distribution of water, including the cost of materials, labour, and renewals	2,247 14 1		
Pumping and engine charges, including the cost of coals, wages, &c.	3,814 16 3		
Filtration, including the cost of materials and labour	394 19 9		
Salaries of Engineer, Inspector, Superintendent, and Clerks, and wages of Turncocks	1,850 16 0		
Thames Conservancy	1,050 0 0		
Rates and taxes, exclusive of income-tax	3,540 17 5		£13,631 1 11
Management.			
Allowance to Directors	£600 0 0		
Allowance to Company's Auditors	39 7 6		
Salaries of Secretary, Accountant, and Office Clerks	1,022 10 0		
Superannuation of servants of the Company	355 2 0		
Commission to Collectors	990 17 6		
Stationery, printing, and general establishment charges	281 10 1		
Law and parliamentary expenses	852 15 8		
Official Auditor and Water Examiner	60 3 4		
		4,202 6 1	
Dividend and interest account for transfer of profits		29,161 19 1	
Balance carried to next account, to provide for losses		2,000 0 0	
		£48,995 7 1	

Cr.—REVENUE ACCOUNT.

By Balance brought from former account	£2,000 0 0		
Less sums written off as losses—viz.:			
Empty houses	£1,440 13 4		
Bad debts	94 4 0		
	1,534 17 4		
	£465 2 8		
Water-rents accrued to date of this account	48,211 1 7		
		£48,676 4 3	
Rents of houses and lands accrued to date and owing to the Company		311 2 10	
Fees received for registration of stock, transfers, &c.		8 0 0	
		£48,995 7 1	

The GOVERNOR: Gentlemen, in moving—"That the Directors report be received, adopted, and entered on the minutes," I will make a few remarks on some portions of that report. It would appear that our water rental has increased by £1361 8s. 5d., as compared with the corresponding period of the previous year, the cost of maintenance and management, amounting to £17,833, has been £1854 in excess of the cost in the corresponding period of last year. That is owing chiefly, as the proprietors would probably expect, to the maintenance of the new works and pumping establishment at Molesey, and the increased law and parliamentary charge. I am sorry that the latter charges have increased, and I cannot say that still further augmentation will not take place. It is a very considerable burden on us, but during the last session we had to meet the two Bills proposed by the Metropolitan Board of Works, and also to bear our proportion of the expenses incurred with respect to the Bill, which was carried, with regard to the Thames Conservancy. The two Bills of the Metropolitan Board of Works were withdrawn. As regards the Thames Conservancy Bill, I will say a few words presently. The Metropolitan Board of Works, who are not altogether daunted by their non-success of last session, still hoped to get the assistance of the Government to re-introduce those two Bills. I believe, however, it is now well known that the Government will not afford such assistance, and the Bills have been withdrawn. I think there is no doubt, therefore, that we have seen the last of them, at all events for the present. The several Companies having a common interest in meeting and opposing these Bills, the expense of doing so is rateably apportioned among them according to their water-rental. The account against this Company with regard to the Bills of the Board of Works has, I think, been ascertained and settled; but that for the Thames Conservancy Bill is not yet complete, and therefore we cannot tell you what our proportion of the expenses will be. The capital account shows an expenditure of £6838, and includes the payment of all the contractor's claims in respect to the Molesey works. Those works are now all finished and paid for. The other final estimate was £190,630, and the total cost has been £204,678, showing an excess beyond the estimate of some £14,000, but in so large a sum this is not a very great difference.

The SECRETARY: And there is nothing more to come into charge under that head?

The GOVERNOR: No. Then the report states that the Government Water Examiner, in his monthly returns, continues to report favourably on the quality of the water supplied by us; and that, I think, is satisfactory. A contract has been entered into for providing and laying down an auxiliary supply-main from Stamford Bridge, Fulham, to Ebury Bridge, Pimlico. That will be a distance of 2 miles 2 furlongs 267 yards, to speak accurately, and the contract price is £9625. We expect that the work will be finished by Lady-day next. A main, to which, no doubt, reference has been made on a previous occasion, was laid during last year, and it may be described as running from Eaton Square to Charing Cross. It was found advantageous to have these auxiliary mains. They increase the pressure of existing mains, and are, of course, serviceable in case of anything happening to throw any of the works out of order. The constant supply service is now given to all the houses built and building on the several new estates in course of erection in different parts of the Company's district. These estates I will just mention to you. One is in Hans Place; another in Elm Park, Fulham Road; another is called the Salisbury Park Estate, in Fulham; there is one at Cremorne; and a fifth is on the Thames Embankment. Those buildings are all constructed for receiving a constant supply, and it is now being generally given by this Company. With regard to the Thames Conservancy Bill, you may be aware how we stood with the Conservators before this Act of Parliament was obtained. For a great many years we had been liable to make a payment to them of a sum of £300 a year, and also for a less number of years of a sum of £1000. Therefore, prior to the passing of this Bill, we made them an annual payment of £1300. They asked by their Bill for further contributions by the Water Companies, and all the Companies taking their water from the Thames are in future to pay an additional sum of £1000. We shall, therefore, in future have to pay £2300 instead of £1300, as hitherto. We made some slight demur at first, with the view of ascertaining a little whether the contributions made by the Companies could be said to be fairly applied to the purposes for which they were given—namely, to the purifying of the water—and whether too much money was not laid out on locks and weirs and other matters which could hardly be said to be so closely connected with the interests of the Companies. The answer received was that the maintenance of locks and weirs equalized the flow of the water, and their being kept in a proper state was a matter of great importance, and had led indirectly, if not directly, to benefit the Companies very much. However, that is how matters stand at present—that in future we pay the Thames Conservancy £2300 a year instead of £1300. There is nothing more for me to detain you with, except to refer you to our recommendation as to the dividend. I will not, therefore, trouble you with any further remarks. I now beg to move—"That the Directors report be received and adopted, and entered on the minutes."

Major-General BOILEAU said he should be most happy to second the resolution. He believed the Shareholders could find no fault with the report. He was sure they were much obliged to the Governor for the explanations he had given, and he believed they would all readily join in the adoption of the report and accounts. There had been, as they would see, an increased expenditure as well as an increased revenue. The proprietors were quite aware that the increased expenditure arose in great measure from the parliamentary expenses which the Metropolitan Board of Works entailed on the Company last session. It was satisfactory to find that that expenditure was not likely to be repeated, because they found that the Board of Works had voluntarily abandoned the Bill for giving an extra or second supply of water; and, with regard to the other Bill, it had been relinquished by the Board—not voluntarily, but because they could not get the support of the Government. For these reasons they had given up the idea of going to Parliament this session for powers for purchasing the interest of the Water Companies, and he thought this was very satisfactory to them to know. It was also a comfort to know that, though there had been an increase of £1800 in the cost of maintenance and management, it was not likely to be repeated, because they had heard that the Molesey works were finished, and they might now expect some return on the £200,000 expended on those works. He should like to know the diameter of the new main from Stamford Bridge to Ebury Bridge.

The GOVERNOR: About 24 inches.

Major-General BOILEAU: They would no doubt find this of great service to their supply. He looked for an improvement in their revenue from the building of better houses in their district, which was what might be called a "limited district." On the whole, he thought they might take a very favourable view of the state of the Company. He begged to second the resolution proposed by the Governor.

The motion was at once carried unanimously without discussion.

On the motion of the GOVERNOR, the following resolutions, which were put *seriatim*, were also carried unanimously:—"That the accounts as laid before the meeting be received and entered on the records." "That the Directors of this Company be and they are hereby authorized to set apart, out of the profits of the Company, so much money as will be sufficient to pay the dividends, which will become due on the 4th day of January next, on the several preference stocks issued by this Company." "That a dividend for the past half year, at the rate of £6 per cent. per annum, on the ordinary capital stock of the Company, be now declared out of the profits of the Company, and be paid on the 4th day of January next to the several persons and corporations who are on this day proprietors of such capital stock."

Major-General BOILEAU then moved a vote of thanks to the Governor and Directors for their care and attention to the interests of the Company, of which the proprietors had ample proof.

Mr. WEGG seconded the motion.

The GOVERNOR, in reply, assured them that the Directors had the greatest pleasure in doing anything they could to promote the interests of the Company, which they always had at heart. He might be allowed to make one more remark, which was that he was afraid the expenditure of £200,000 on the Molesey works would not result in anything very remunerative to them, as the outlay did not give them a single additional consumer.

Major-General BOILEAU remarked that the works would give the Company increased credit and stability.

The proceedings then terminated.

BEYROUT WATER-WORKS COMPANY, LIMITED.

The Annual General Meeting of this Company was held at the Offices, 17, King's Arms Yard, Moorgate Street, on Friday, the 20th inst.—W. P. ANDREW, ESQ., in the chair.

The SECRETARY (Mr. Robert M. Young) having read the advertisement convening the meeting, the following report was taken as read:—

The Directors herewith submit, for the information of the Shareholders, their fifth annual statement of accounts, to the 30th of September last, duly audited.

Appended hereto will be found a full and detailed report from Mr. J. E. Cornish, the Company's Engineer and Local Manager, of the proceedings at Beyrout during the past current year.

The Directors have the satisfaction of reporting that the current local year's expenses at Beyrout for salaries, &c., have been reduced by upwards of £450.

An agreement for the settlement of all outstanding accounts with the contractor for the works has been arranged; the payment of £5000, the final balance, to be deferred, without interest, until July 1, 1881, in the expectation that the growing revenues of the Company will, ere that date, suffice to meet their engagement.

The Company's acceptance, payable at that date, has been handed to the Contractor, and, subject to the approval of the Shareholders, it has been agreed that such acceptance shall be collaterally secured by a debenture to be issued for a like amount, to take rank after and subject to the present issue of £135,000.

It will be observed that the balance-sheet shows very large reductions under the several heads of "Creditors on bills on open accounts" and "Debenture Interest. A large portion of these reductions has been effected by voluntary sacrifice on the part of many individuals, and without any cost whatever to the Company.

They would specially mention that the holders of the Company's debenture coupons have, voluntarily, to the extent of upwards of £20,000, delivered the same up to be cancelled.

The several holders of a large proportion of the deferred or ordinary shares have also transferred the sums respectively registered in their names into those of the Chairman and Mr. J. Staniforth, to be held by them as trustees of the Company, thus practically extinguishing the same.

Two of the Directors—viz., Messrs. Adolphus William Young and Ibrahim J. Tabet—retire from office, but, being eligible, they offer themselves for re-election.

The Auditors of the Company, Mr. W. T. Western and Messrs. Moore and Wallace, offer themselves for re-election.

The Directors recommend that Mr. Charles Watkins be re-appointed Auditor of the local accounts at Beyrout for the current year.

ENGINEER'S REPORT.

Beyrout, Nov. 11, 1878.

The accounts and balance-sheet up to the 30th of September, which were forwarded to you by the mail of the 30th of October, will, I trust, have given you all the information you require, as far as accounts are concerned; and I find some difficulty in endeavouring to sum up the few facts relating to the past year's working which may be of interest to the Directors, on account of the extremely uneventful year which we have passed in all that relates to the Company's works in Beyrout. When I reported to you on the working of the previous year, the country was at war; peace was anxiously looked for, and it was the general opinion that as soon as it was declared, not only would the trade of Beyrout immediately begin to improve, but that it would have a marked effect on the increase of demand for water supply.

This, unfortunately, has not been the case; and, although the town is, I believe, in a more prosperous condition than it was last year, the improvement is very slight.

During the year we have put in 64 new services, and some of the old subscribers have increased the quantity they take. On Sept. 30, 1877, we had 501 contracts, representing 559 cubic mètres, and we have at the same date this year 559 contracts, representing 628¾ cubic mètres of water per day.

The amount received for surplus water is also in excess of that received last year by about 600 piastres.

The collection of water-rates from subscribers has been less troublesome this year than previously, and the payments from the Municipality have also been more regularly made, though they are generally somewhat in arrear: for instance, of the half year's subsidy due on the 14th of October, they have paid us 8000 frs., leaving the balance of 22,000 frs. in arrear; but of this sum we may soon expect to receive some instalments. The foreign exchange has been maintained throughout the year at an unusually high rate; formerly the £1 had an uniform value of £126¼ piastres, and paper at sight on London could be bought at 127½ to 128; now it cannot be had at less than 133¾ piastres, and this again has involved a loss of £129 during the past year on the sum remitted to you (amounting to £2950).

We have included in the amount of bad and doubtful debts the legal expenses incurred during the year, amounting to about 1800 piastres, a considerable portion of which was spent in the prosecution of one of the Company's servants for theft. Although the case was a very clear one, the Tribunal gave us an immense deal of trouble to obtain a sentence, which was ultimately given for six months hard labour.

A new Municipality for the town was elected some few months since, under the presidency of Fakir Bey, a man of considerable influence, who, although a Moslem, has an extensive knowledge of European civilization, and is doing his best to introduce improvements as far as the small means at the disposal of the Municipality will admit of. The new council have not renewed the proposal for additional public fountains which was made by their predecessors, but I have no doubt they would be happy to hear on what terms the Directors would be prepared to accept that proposal.

There has been no accident of any importance on any part of the Company's works during the past year, with the exception of a burst which took place on the masonry conduit in the Dog River Valley, on the 6th of August. A piece of the outer wall of the conduit, 60 feet in length, sunk to such a depth as to pass a large quantity of water, and before the supply could be shut off, the foundations and surrounding bank were much damaged. Although the necessary repairs were commenced as soon as possible, and continued without intermission until finished, there was a stoppage of water service in the town of two days on the low service, and three days on the high service; this was exactly the time I had estimated as the probable stoppage, and had given notice of it to the Municipality as soon as I had seen the importance of the accident, but I found afterwards that they had expected the delay would be much greater. The cost of repairing this burst was about £30. I had passed over the point at which the burst occurred two days previously, and two of our men had passed it on the morning of the accident without seeing any leak or cause of alarm; nor have I since been able to find any satisfactory cause for the accident, though I examined the place very closely while pulling it down before re-building.

This is the only stoppage we have had on either service during the past three years.

I have not thought it necessary to send you a list of the persons in the Company's employ here, as there is no change since last year, with the exception of one man having been sent away, and replaced by another at the same wages; I have also dispensed with the policeman sent by the Lebanon Government in the Dog River Valley, as I found him of no use; I believe the Pasha was rather annoyed at our not keeping him on, but I think that, on the other hand, the Government should themselves pay for a policeman if one is required there. I may add that the valley is so unhealthy in the summer months as to require a constant change of men, unless they are as well acclimatized to it as our men fortunately are now.

During the year I have endeavoured to keep the working expenses as low as is possible without neglecting necessary repairs. Last year some work had to be done in the bed of the Dog River, below the weir, at a point at which the river was deviating from its course; the last winter's floods have made some further work necessary at the same place, and I have had this completed previous to the wet season, which may be expected to set in within a few days.

A subject which is attracting more attention than any other just now in Beyrout, is the question of railway communication with the interior; as Beyrout is the only commercial town of much importance on this coast, and has decided advantages over most other points, both with regard to its healthy climate and its adaptability for the construction of a good harbour, it has certainly a great claim to be taken seriously into consideration in any project for a railway from this coast to the interior, either as a means of developing the agricultural wealth of the country, or as a point of departure for the Euphrates Valley Railway. It has usually been taken for granted that, being opposite the centre of the Lebanon range of mountains, Beyrout should be naturally cut off from railway communication; but on a closer examination it will be found that this difficulty is much less than it would at first appear; and that, taking Beyrout as a point of departure, the mountain range can be passed either to the north or south without great expense, and that it is not impossible to cross it even in an almost direct line. The inhabitants of Beyrout are fully aware, not only of the great advantage it would be to their town to be put into railway communication with the interior, but also the immense loss it would be to them if the town should be left out of consideration in the execution of such a scheme. In either of these views the interests of the town of Beyrout are closely allied with those of this Company; and if the town could be made the terminus of a railway, there can be no doubt that it would rapidly increase and become a place of very great importance.

From a strategical point of view no place on the coast could compare with Beyrout; the command of the sea, and the few mountain passes by which it can be approached, would make it much easier to hold, and consequently much better suited for a point of departure than any other; whilst the thickly-populated districts of the Lebanon would furnish large numbers of good labourers for the construction of the works required.

I consider this subject to be of great importance to the Company, and well worthy of the consideration of the Directors. With the view of becoming better acquainted with this question I have given up more time to its consideration than I should have felt justified in doing to any other subject not connected with the Company's works, so fully do I feel its importance; and I am convinced that nothing I could do might be of more service to the Company.

Should peace continue, the state of the town will, without doubt, gradually improve, and we may hope for an increase of business next year; but unfortunately there is at present a feeling of distrust, and I think a general belief—or, I should say, fear—that the peace may not be a permanent one. (Signed) J. E. CORNISH.

To the Secretary, Beyrout Water-Works Company, Limited.

The CHAIRMAN, in moving the adoption of the report, said they would remember that the Company's works were opened under the most happy auspices, but very soon afterwards, Beyrout was overwhelmed by every possible disaster. The pestilence of cholera, the destruction of the silk crop, and, finally, war between Turkey and Russia. It was quite evident that under such circumstances it was utterly impossible that any new undertaking could flourish. He regretted to say that, notwithstanding that peace had been declared, the feeling left on the town was still one of great uneasiness. There appeared to be alarm lest hostilities might be recommenced. There was one very fortunate circumstance which had occurred, and he could not but regard it with great hope, and that was the appointment of Midhat Pasha as Governor-General of Syria. With that illustrious statesman he was well acquainted, his Highness being a member of the Stafford House Committee, of which he (Mr. Young) had the honour to be the chairman. His Highness had arrived at Beyrout, where he was singularly well received, and he (the Chairman) had had a message from him, saying that he was most anxious to avail himself of his assistance in effecting all the improvement he possibly could for the province over which he ruled—namely, the improvement of the Docks at Beyrout, a railway from that place to Damascus, and sundry other works. He had already sent his Highness a verbal message, and he proposed to inform him by letter that, having invested £4000 in the Beyrout Water-Works Company, and having received no return whatever on his money for the last two or three years, he expected that his Highness would issue such instructions to the Municipality as would induce the inhabitants to use the water largely, and therefore give some return for their capital; that it was the first undertaking in Beyrout supported by British capital; and that if it paid a moderate return there would be no difficulty in carrying out his Highness's wishes for the other improvements he contemplated carrying out. His Highness was a great admirer of England and all her institutions, and he (the Chairman) thought he might mention to him that householders in certain parts of London were almost compelled to take water, even if they were proprietors of uninhabited houses, and that he would be very glad if his Highness would issue an edict, making it almost compulsory on the inhabitants of Beyrout to be greater consumers than they had hitherto been—for the sake of their health among other reasons—of the water supplied by the Company, which was perfection as regards quality, and was to be had in abundance. He need not say that it was a great disappointment to them all—to him especially—that the inhabitants had not come to the Company as he expected, even under the adverse circumstances to which they had been exposed, and supported the undertaking. However, under the misfortunes which had attended them hitherto, the Board had done their very best to promote the Company's interests. They had reduced the debt slightly; they had, he thought, brought down the expenses to the lowest possible limit; and they had done all they could, by making a reduction in the rates, and by meeting the inhabitants in every possible way, to induce them to take the excellent water which they drew from the Lebanon and supplied to the town, instead of the brackish, nauseous stuff which they had hitherto been in the habit of using. He might allude to the position of Beyrout itself, as, of course, their prosperity was bound up in that of the town. Since he last saw them, England, as they were aware, had obtained possession of Cyprus. There was a large trade springing up between Cyprus and Beyrout. Many more steamers now called at Beyrout, and there was a talk of a sanatorium now being established in Lebanon for the officers and soldiers of the garrison of Cyprus. Not that Cyprus itself would not be a sufficiently good climate, after certain sanitary improvements had been made, but in the meantime it had, no doubt, injuriously affected the health of the recent European settlers and of the troops. He concluded by moving—"That the report and accounts be received and adopted."

Colonel EVELYN seconded the motion.

The CHAIRMAN, in reply to Mr. Sanville, said that the amount of water supplied to the ships had been considerable, and the full price was paid for it. It was an increasing item in their receipts, and that was why he alluded to the frequency of steam communication, which, as far as one could form an opinion, was likely to go on increasing. If, too, the other improvements proposed by Midhat Pasha were carried out, there could be no question that the commerce of the port would be immensely increased, because the country behind Beyrout was very fertile and most productive, and its productions were of that valuable nature—such as silk and olive oil—that would promote immensely the wealth of the inhabitants. He could not but look forward to a good future, notwithstanding the unpleasant gloom which at present surrounded the Company. He might also allude to another matter, which was peculiarly interesting to him. There was no question that it would be connected by railway with the Great Trunk line, for it was laid down as one of the branches on the Turkish Government map—the branch to Beyrout—and Midhat Pasha was most anxious even now that it should be connected with Damascus, and others in Syria were very anxious that it should be connected by a railway with Tripoli. Midhat Pasha himself had told him (the Chairman) that he had, when Governor-General of Bagdad, had the country lying between Bagdad and Tripoli surveyed, and his Highness begged of him, thinking the thing was in some degree in his hands, to make Tripoli, instead of Alexandria, the port of the railway; and, if that should be done, the town of Beyrout being only 30 miles from Tripoli, and having the advantage of first-rate labour, as they knew from experience, excellent stone for building purposes, and many other appliances for the construction of public works, there was no question that an enormous benefit must accrue, sooner or later, to the town of Beyrout, and if to the town, of course to the Company, as suppliers of water. As he had said, they had done everything, short of selling the water at a loss, to meet the views of the people. They suffered from one great drawback. They supplied, of course abundantly, the public fountains, and the Municipality, he might say, had kept faith with the Company as well as they could—wonderfully well for Orientals. Although they were a little behind, still they always paid. The great drawback to which he referred was that the donkey-boys, who used to carry the brackish water from the rivers, stole the water from the fountains and sold it to the inhabitants, who ought to pay the Company for their supply. They hoped this difficulty would be removed in course of time. He looked forward to a number of difficulties, which were not only a nuisance, but also a loss to them, being removed, now that Midhat Pasha had been appointed to rule over the province.

The motion for the adoption of the report was then put and carried unanimously.

Mr. F. PAVEY moved—"That Messrs. W. P. Andrew and John Staniforth be requested to act as trustees on behalf of this Company in respect of all ordinary or deferred shares now or hereafter transferred, or to be transferred, into their names in that behalf." The object of the resolution appeared to him to be very desirable.

Mr. ROSE seconded the motion, which was carried unanimously.

The retiring Directors and Auditors were then unanimously re-elected, Mr. Charles Watkins being re-appointed Auditor of the local accounts at Beyrout.

The meeting was then made special—"for the purpose of considering and sanctioning the terms of a security for £5000, already agreed to by the Board of Directors, and proposed to be given to the contractor as part of the general settlement of accounts between himself and the Company."

The SECRETARY having read the resolution in accordance with the above,

The CHAIRMAN, in moving the adoption of the resolution, said the arrangement proposed by it was in lieu of payment in cash. Instead of cash they gave an acceptance of the Company, and as collateral security they lodged certain debentures (referred to) which ranked after the debentures which were already issued.

Mr. SANVILLE seconded the motion, believing that the proposed arrangement was the best which could be made under the circumstances.

The resolution was then unanimously carried, and the meeting separated, after passing a vote of thanks to the Chairman.

THE SEWAGE QUESTION AT ROCHDALE.—To prevent the further pollution of the Roach, and to comply with the provisions of the Rivers Pollution Act, the Rochdale Town Council have instructed Mr. R. Vawser, C.E., of Manchester, to complete the necessary plans for intercepting and purifying the sewage of the borough. As the works will be very extensive, the plans cannot be got ready for some time; but as soon as they are prepared it is intended to submit them for the approval of the Local Government Board, and to commence the works immediately. A considerable time must, however, necessarily elapse before the works are completed.

ANNUAL DINNER OF THE SOCIETY OF ENGINEERS.

Last Wednesday the Annual Dinner of the Society of Engineers took place at the Guildhall Tavern, Gresham Street—Mr. Robert Paulson Spice (President) in the chair, supported by Mr. Charles Horsley, Mr. Alfred Williams (Hon. Sec. and Treasurer), Major Latham, Major Campbell, Mr. Jabez Church, Mr. Perry F. Nursey, Mr. W. H. Bennett, Mr. J. Bernays, Mr. T. Gibson, and others.

The toasts of "The Queen" and "The Army, Navy, and Reserve Forces" having been drunk,

The Chairman proposed "Success to the Society of Engineers." He said that nothing succeeded like success; and it was satisfactory to know that the Society of Engineers had been a success. They would all agree in the hope that the Society might be a success not only for many years, but for many generations. It was an important Society, as training young gentlemen for most important duties. It enabled young men to compare notes, to receive information, to examine works in progress—by no means the least part of the work performed by the Society. All who had had the advantage of paying the visits of inspection allowed that the benefits arising therefrom had been very considerable. He coupled the toast with the name of Mr. Alfred Williams, who, he said, might be regarded as the founder of the Society.

Mr. Williams (Hon. Secretary and Treasurer), in reply, said that this was the twenty-third time he had had the honour of returning thanks for this toast. He remembered the early days of the Society, when it was called the Putney Club, and when the meetings were held at a cigar-shop, or elsewhere. He maintained that young men learning civil engineering wanted more than experience on paper—that of drawings, plans, &c.; they ought to see works in actual progress, and the Society afforded them that opportunity.

Mr. Horsley proposed "The Chairman," who, he said, had not only been President of the Society in the past year, but was the President-Elect for 1879.

The Chairman responded to the compliment in well-chosen terms.

The remaining toasts were:—"The Vice-Presidents and Members of the Council for 1878," "The Visitors," "The Auditor and Secretary" (Messrs. Mr. W. H. Bennett and P. F. Nursey), "The Press," and "The Ladies."

A selection of music was executed at intervals during the evening, under the direction of Mr. Montem Smith.

INSTITUTION OF CIVIL ENGINEERS.

The Annual General Meeting, "to receive and deliberate upon the report of the Council on the state of the Institution, with the annual statement of accounts, and to elect the Council and Officers for the ensuing year," was held last Tuesday—Mr. J. F. Bateman, F.R.SS. L. and E., the President, in the chair.

The report stated that during the past session 95 Associates had been transferred to the class of Members, 56 Members and 205 Associates had been elected, and 15 Members and 42 Associates had been removed from the books by death or otherwise. There had thus been an increase of 136 Members and 68 Associates, together 204, or at the rate of upwards of 7 per cent. There were on the books, on the 30th of November last, 16 Honorary Members, 1061 Members, and 1738 Associates, making a total of 2815, whereas ten years back these numbers were respectively 16, 637, and 896, or in the gross 1549. There were besides 500 Students attached to the Institution, out of the 965 that had been admitted since the class was established eleven years ago. Of the balance, 254 had become Associates, and 211 had ceased to remain on the lists. In conclusion, the Council stated that the progress of the Institution during the past twelve months had been not less satisfactory than in former years. This was the more gratifying when it was considered that there had been a wide-spread and deep-rooted financial depression for so long a period, and that the well-being of the Institution was largely dependent on the prosperity of the country. The anxiety of Engineers to be enrolled on the register of the Institution might be taken as evidence of the esteem in which it was held.

The report having been adopted, the premiums and prizes awarded at the close of last session were presented by the President, to whom the thanks of the meeting were unanimously voted, the service of the Vice-Presidents and Council, of the Auditors, and of the Secretaries being similarly acknowledged.

The Scrutineers reported that the following gentlemen had been duly elected to fill the several offices in the Council for the ensuing year:—Mr. John Frederic Bateman, F.R.S., President; Mr. J. Abernethy, Sir W. G. Armstrong, C.B., F.R.S., Mr. W. H. Barlow, F.R.S., and Mr. J. Brunlees, Vice-Presidents; Mr. W. Baker, Sir J. W. Bazalgette, C.B., Mr. G. Berkley, Mr. F. J. Bramwell, F.R.S., Mr. G. B. Bruce, Sir John Coode, Mr. W. Froude, M.A., F.R.S., Mr. A. Giles, M.P., Mr. H. Hayter, Dr. W. Pole, F.R.S., Mr. R. Rawlinson, C.B., Dr. C. W. Siemens, F.R.S., Mr. D. Stevenson, F.R.S.E., Sir Jos. Whitworth, Bart., F.R.S., and Mr. E. Woods, other Members of Council.

THE WATER SUPPLY OF HONITON.

A Special Meeting of the Honiton Town Council was held on Friday, the 13th inst.—the Ex-Mayor (Mr. J. Knight) in the chair.

The principal purpose for which the meeting had been called was to receive from the Engineer (Mr. Ellis) a report upon, and plans for a proposed water supply for the town. The question of an efficient water supply has been a matter of much contention in the Council for many years past, the contending elements being the "water party" and the "anti-water party." Various plans have from time to time been brought up and rejected. One was drawn up which, in the opinion of the majority of the Council, was too costly, and they referred it back to the Engineer for modification. This course was taken by the "anti-water party," who were in the ascendancy; but, in the meantime, a letter was written to the London and South-Western Railway Company, asking for permission to enlarge a tank on their line, from which the town now receive part of their water supply. It is highly important that some action should be taken quickly, as the Local Government Board some two months ago threatened that if plans were not submitted for approval within four months, they would compel the Council to provide an efficient water supply.

The following is an epitome of the report accompanying the modification of the original plans which had been submitted to the Council for approval:—Having considered the question of a water supply for Honiton, and to what extent a modification of his views could be judiciously made, so as to meet the requirements, and to give an efficient supply of good drinking water to the town, after a frequent inspection, during the past twelve months, of the source of supply, Mr. Ellis was able to speak with a greater degree of certainty as to its capabilities. From a careful examination of the subsoil, and by gauging the springs, he was satisfied that a minimum of 20 gallons per head for the population could be obtained. This would afford an ample quantity of water for drinking and domestic purposes, the existing supply being used for flushing purposes. In order to make the proposed supply available for every house in the town and suburbs at a high pressure, he recommended the construction of a service reservoir near the turnpike-gate on the Axminster turnpike-road, on a piece of land belonging to the Council, at an elevation of about 100 feet above the highest part of the town. This reservoir would be capable of containing 100,000 gallons, and would be supplied by several springs at the foot of Springfield, which he proposed to convey to the reservoir by glazed stoneware pipes. The report then went on to describe the manner in which the water should be distributed over the town by means of cast-iron pipes. The cost of hydrants, sluice-valves, construction of covered sluice reservoirs, and every arrangement for giving as ample and efficient a supply of water as could possibly be wished for, and such as the Local Government Board would approve, would, he estimated, be £1354 10s., at the present price of iron. A moderate water-rate charged to the consumers would meet the principal and interest expended in acquiring the supply.

The Clerk (Mr. Tweed) read a letter from the London and South-Western Railway Company, giving their consent to the enlargement of the tank on their line, from which the present supply of water for the town is partly obtained; the main stipulations being that the Council should keep it in repair, and that if the Company saw fit they could, by giving three months notice, withdraw from the agreement.

The Chairman said that the spring which supplied the tank with water was a very valuable one, and was appreciated as such, and they ought to be thankful to the Railway Company for allowing them to enlarge the tank.

Alderman Hook moved that the offer of the Railway Company be accepted.

Major Swann said he should decidedly object to the proposition, unless the water which supplied the tank were made potable. Whenever it rained the water was perfectly undrinkable.

The Chairman remarked that the water had been analyzed and found to be pure.

Major Swann said the Chairman was perfectly well aware that whenever it rained the water was of the consistency of pea-soup, and he was quite certain that at those times no analyst would pass it as pure. They had had two samples brought into the Council Chamber on one occasion, but the one produced by the Chairman's party had been taken from the spring when clear, and the other when it was thick and muddy.

The Chairman thought the Council ought to accept the offer of the Railway Company. The water had been analyzed——

Mr. Ashley (interrupting) said they had nothing in writing from the Engineer as to whether the water was pure or not. They were, however, wasting time in a discussion when they knew there was another report from Mr. Ellis coming under consideration, respecting a proposed new water supply. He thought the matter ought to be dropped entirely, as, with another supply in view, the enlargement of the tank would only be throwing money away. That, however, was only a principle they had been acting on for some months past. The ratepayers would soon find out who were to blame, and put a stop to it when they found their pockets touched. Whatever course they would adopt he knew their (the opposition party's) own consciences would tell them that the scheme originally brought forward, which had now been modified, was the best, and what was the best was the cheapest. It would have cost £2300, but they would have had a good water supply, and there would have been an end of it. Now they had substituted a scheme which would cost only £1500, and no one knew how much more besides. He should move, as an amendment, that the offer of the Railway Company be not accepted.

After some conversation, Alderman Hook's motion was put and carried.

The plans and report of the Engineer were then laid before the Council.

Major Swann objected to the discussion of the plans unless the Engineer were present to explain them.

Alderman Hook said he could not see why the presence of the Engineer was required. Mr. Ellis stated in his report that the plans would doubtless meet with the approval of the Local Government Board, and they might depend upon it he would not alter those plans, seeing that they had been prepared according to instructions. He would move that the plans be accepted, and that application be made to the Public Works Loan Commissioners for the requisite sum for carrying out the work.

After some conversation, a formal amendment was drawn up to adjourn the matter for the attendance of the Engineer, but was not put to the vote. Alderman Hook's motion, accepting the plans and asking for power to borrow the necessary money, was carried.

The other business of the Council was then disposed of, and the proceedings, which, as usual, were of a somewhat turbulent character throughout, terminated.

THE ELECTRIC LIGHT *VERSUS* GAS.

The German View of the Question.

As the introduction of the electric light for street illumination in Paris excited considerable attention in Germany, the following reproductions of articles that have appeared in that country may not be altogether without interest at the present time, when, under the auspices of our leading Municipal Authorities, experiments are being made with the view of testing the adaptability of the new system for the public lighting of certain parts of the Metropolis:—

When in the year 1867 some successful trials of M. Tessié du Motay's oxy-hydrogen light were made in several of the streets of Paris, it was thought by many that the last days of gas lighting had come. The shares in the Paris Gas Company dropped several hundred francs, and unbounded admiration of the new discovery was everywhere expressed. At the present day people no longer talk about that light, but from the experiment made with it a salutary lesson has been learnt in France, as testified by the perfect indifference with which the shareholders in the Paris Gas Company contemplate the present much more extensive and more determined application of the electric light. On the other hand, however, the panic seems at the present time to be manifesting itself in Germany. This is proved by the fall that has taken place in the shares of the principal gas companies there. We think, therefore, that it will not be unprofitable, in view of the multitudinous interests associated with this subject of the electric light, and its possible competition with gas, if we try to ascertain whether there is any real cause for these apprehensions, or whether, on the contrary, they have no foundation whatsoever to rest upon.

To all appearance, the electric light has, in a very short time, made extraordinary commercial progress, and the few isolated and restricted applications—or, to speak more correctly, the trials, the first of which was made in the Magasins du Louvre—of the light that took place some two years ago in Paris, have since developed in various directions, and have justly attracted the attention of the numerous visitors to the Exhibition.

The Jablochkoff candles afford the possibility, to a certain extent, of dividing the electric light; and this invention has, in a manner, altered the position of the point of departure for the new system. These candles take the place of the regulators formerly employed, which consisted of two carbon pencils, burning very irregularly, held together at an equal distance one from the other, by means of two other pencils parallel with the first, and separated by a layer of sulphate of lime as an insulator. Several of these candles may be placed upon a single circuit; but, in actual practice, the number has not generally exceeded four. It is beyond dispute that

the Jablochkoff process, which at once dispenses with the complicated regulators, and furnishes a superior light, is a proof of great technical progress, and, if the respective costs of the two systems are taken into consideration, allows of a considerable extension of the application of the electric light, but it is no less true that, as the question stands at present, perfectly satisfactory installations of that light cannot be effected.

In proportion as greater experience is acquired on the subject, these imperfections will undoubtedly, to a certain extent, be remedied; nevertheless, technical progress is not necessarily at the same time economical progress, and we hope to be able to show how, in this respect, the possibility of competition between the electric light and gas diminishes rather than increases.

We will first of all place before our readers the net cost of the new system of lighting now in use in Paris—a system that has caused the pulic so much amazement. [The writer then refers to the lighting of the Avenue de l'Opéra, and gives the cost of the electric light employed there as against that of gas, showing that the former is nearly six times in excess of the latter.]

It seems to us that, on the face of this diversity, no one can, economically speaking, pronounce in favour of a system of illumination, the progress lately made by which we have studiously guarded ourselves against ignoring, although that progress was, in our opinion, tending rather to the luxurious than to the useful, inasmuch as the new light is incontestably of greater luminous intensity than is necessary. Be that, however, as it may, even supposing that we wished to obtain an equivalent illuminating power with gas, we say that 12 gas-jets, each consuming, at the most, 5 cubic feet per hour, or 60 cubic feet in all, would furnish such power. If we calculate this quantity of gas at the price per hour for each electric lamp, we shall find that the cost would be three and a quarter times higher than that of the gas burned in the street-lamps in Germany.

We shall, of course, be told that these 12 gas-jets will not be sufficient—although, for our part, we are convinced to the contrary—that 15 or 18, at the very least, will be required to produce a light equal to that furnished by an electric lamp; and that by degrees, as further progress is made, the cost of the electric light will be reduced to one-half. Even admitting that that result will eventually be attained, it will be none the less true that lighting by gas will still be very much the cheaper of the two systems. If we only consider that the outlay per hour for the carbon pencils is at least 6d. (one candle, lasting practically 75 minutes, costs 7½d.), this figure is equivalent, if one electric lamp may be substituted for twelve gas-burners, to an expenditure of one halfpenny per hour for 5 cubic feet of gas. For the consumption of the carbons only, therefore, leaving out of the account the cost of motive power, wear and tear, labour, interest, and sinking-fund, we have an outlay very nearly double that which an equally perfect lighting by gas would necessitate.

It is true that, in the amount originally paid per candle per hour (1s. 2½d.) by the Municipality of Paris, was included whatever sum the Jablochkoff Company might claim for themselves in the shape of profit; but, in the face of the great disparity existing between the prices of the electric light and gas, we do not believe that, even if the Municipality were themselves to take the matter in hand, the figures could be very materially modified, for, as will be seen by what follows, it is very doubtful whether, even with the price they paid, any profit was left to the producers.

In the programme developed by the Jablochkoff Company at the International Exhibition, the maximum expense of a machine supplying sixteen candles did not exceed 65 centimes. (6½d.) per hour. This figure is evidently too low; besides, the candles, which, as we have said above, cost 7½d. a-piece, are calculated as lasting an hour and a half, while experience has proved that they have to be renewed every hour, or, let us say, in order not to exaggerate, every 75 minutes. The outlay for coal and the wages of the attendant are also certainly reckoned too low by some 15 c. (1½d.), and therefore the total expense should be put down at 8d. instead of 6½d. per hour. There has likewise been left out of the calculation the cost of the maintenance and repair of the dynamo-electric machines, the circuits, the lamps, and the engines supplying the motive power, as well as the expense of replacing the candles, which would certainly bring the total up to 9½d. per hour. Nor do we see anything set down for interest and sinking fund. In Paris, the minimum cost of the apparatus necessary for supplying 16 electric candles is estimated at 35,000 francs (£1400), or about £87 a-piece. In this sum is included simply the purchase of the electric machines, the steam-engines, the circuits and lamps, with their various accessories. In accepting this figure, though it is evidently very far below the actual amount—small circuits, giving but very little light, cost from 3000 frs. to 4000 frs. (£120 to £160) per lamp—and reckoning interest at 5 per cent. and sinking-fund at 10 per cent., we arrive at a total of 328 frs. (£13) per lamp per annum, being at the rate of 18 c. (1·8d.) per lamp per hour for the electric light used in Paris for a period of some five hours per night, or 1825 hours per year.

It results, from the foregoing figures, that the Jablochkoff Company had to sustain an expense of at least 1 fr. 13 c. (11·3d.) per lamp per hour; consequently, out of the 1 fr. 45 c. (1s. 2·5d.) paid to them by the Municipality of Paris, there was left for profit 32 c. (3·2d.). But when it is considered that we have said nothing about the rent of the *locale* for the steam-engines, or about the managerial and other expenses, we think our opinion will be shared by the public—that the Jablochkoff Company could, at the most, only cover their outlay, and leave a balance for interest and sinking-fund.

With regard to the employment of the electric light for interior illumination, it may certainly, in that case, replace a greater number of gas-lights than it would out of doors, inasmuch as in the former case the light would be placed in the very centre of the locality to be illuminated, instead of on its outer edge, as would be the case in the streets. And yet, in the various interior applications of the electric light that have taken place in Paris, a Jablochkoff lamp has rarely, if ever, replaced more than 15 gas-jets at the utmost, the average number being generally 10 or 12. The intensity of the light furnished is certainly rather superior to that of gas; but an equal degree of illumination might be very conveniently obtained from the latter source by using 15 or even 20 burners, each consuming 5 feet of gas per hour.

We estimated at 95 c. (9½d.) per lamp per hour the cost of installation, properly so called. Reckoning 500 hours per annum (the average for interior lighting), together with interest and sinking-fund, we obtain a total of 65 c. (6½d.) per hour to be added to the 95 c., making a grand total of 1 fr. 60 c. (1s. 4d.), which exceeds by 15 c. (1½d.) the cost of street lighting, calculated for 1825 hours consumption. The electric lamps ought, therefore, to be able to replace 20 5-feet per hour gas-jets. In order to spend this 1fr. 60c. in the employment of gas, it would have to cost at the rate of about 12s. 9d. per 1000 cubic feet, which is double the price generally paid by private consumers for gas in Germany, and very nearly three times the amount there charged to large establishments.

The preceding figures are based upon averages, which is, from all points of view, the method of calculation most favourable to the electric light. But even supposing the light to be employed under exceptionally advantageous circumstances—for example, where the cost for motive power, wear and tear of engine, attendance, and other expenses might be saved—reducing the total expenses per light per hour from the 1 fr. 60 c. given above to 79 c. (say 8d.), still, for this sum, a light equal to that furnished by 20 5-feet gas-jets might be obtained. This price would be equivalent to the gas costing about 6s. 6d. per 1000 cubic feet. These exceptionally favourable circumstances, however, when the prices of gas and the electric light would approach at all nearly one to the other, may not exist in one in ten thousand cases; and even then it would be a question of gas at the price paid by private persons, and not at the reduced rate charged to large consumers. Even the superior luminosity of the electric light cannot, therefore, be invoked in its favour, since the same effects may be produced with gas, and, what is more, at less expense.

Far from progress having been made by the electric light as an illuminant, it has, in our opinion, made rather a retrograde movement, and lessened its chances of becoming a competitor with gas, from a pecuniary point of view, since the time of the introduction of the original Siemens and Gramme machines and the regulators. One of the principal advantages possessed by one process over another—their merits being equal—is undoubtedly cheapness. We have already shown how electric lighting, even under the most favourable conditions, is far from being comparable with gas on that score; and we may add that, considering the nature of the light, we doubt very much whether it could ever be employed economically.

It is, however, unwise to attach an undue importance to the question of low price; and nothing shows better to what extent certain other considerations have weight than the competition between gas and petroleum. The low price of the latter article caused it at first to be very extensively employed; but afterwards, although the primary outlay for fitting up was in every respect in favour of the petroleum, people began to discover in gas all the advantages it really possessed. First of all, we will mention the absolute simplicity of lighting by gas. The daily cleaning and refilling of the lamps, the fixing of the wicks, and the inconvenience caused to the sight and smell when petroleum is employed at all negligently, the variability of its qualities, and the constant supervision it requires—all these, with other imperfections, render it very inferior to gas, which can be brought into use by simply opening or closing a tap, while the meter regulates automatically the amount consumed.

It is some such qualities as these that constitute the advantages gas possesses over the electric light. In place of the cleaning and refilling of the lamps, necessitated by the use of petroleum, we have with the electric light a complicated arrangement of machinery attached to delicate lighting apparatus, which, far from being, like the gas-taps, so easy of manipulation that it may be left in the hands of an ordinary person, requires almost professional skill for working it, and scrupulous, constant, and, above all, punctual attention while it is in operation, unless we would see the whole process suddenly brought to a standstill. If, however, we pass on to the possibility of centralizing the production of the light in a small number of stations, as in the case of gas, and sending it by means of conducting-wires to the houses of the consumers, we must bear in mind the fact that, in the present state of the question, such results are altogether incapable of realization, alike for physical and economical reasons. The electric light must be produced almost on the spot where it is used. In large works, where machinery is employed, this will present little difficulty; but how are we to manage in the case of private houses, warehouses, refreshment-rooms, pleasure-gardens, and public buildings? Further, it is almost impossible to rely on anything like a guaranteed and regular supply of the electric light, as we do of gas.

Another difficulty lies in the power of the steam-engines required for the production of the new light. Gas-engines could only be utilized in the case of a limited number of lamps, seeing that each lamp necessitates the employment of at least 1-horse power; and in this fact there may be found one more argument against the practical application of the electric light. While with gas we are able, as we have said, by the simple turning of a tap, to obtain at any moment, day or night, wherever we wish, and so long only as we require it, the exact degree of light to suit our purpose, with electricity we have an extremely concentrated light, produced only at a time when the motive power is in operation. This system of illumination is, therefore, quite insufficient of itself, and some accessory mode of lighting, either by gas or petroleum, must at the same time be provided.

But of all the difficulties in the way of the application of this light, the most serious is certainly the greatly increased expense which the installation of the light entails, and which the consumer has personally to bear; whereas with gas, the primary expenses for plant, gasholders, main-laying, and so on, are borne by the companies, leaving the consumer to sustain the relatively small outlay required for the interior arrangements, fittings, &c. If we except the single advantage of a smaller production of heat, the electric light possesses in a higher degree all the serious inconveniences of petroleum. Before, then, we substitute in commerce the electric light for gas, we ought to be able to realize economical results by its use—to find, at least, that the expenses are about equal, instead of double or three times as great; but it will have been seen, by what has preceded, that this end is far from having been attained.

If the complications of the electric light are such that, to ensure its employment, considerable economy should attend it, it is evident that the increased outlay occasioned for its installation, and the difficulties connected therewith, cease to militate against the new system when it is a question of what might be called *luxurious* lighting, by which it is desired to produce a special and marked effect not obtainable by any of the other methods of illumination. For these special cases, the superiority of the electric light must not be ignored, and it is in this direction alone that it will succeed in making its way. It is not in these cases as in ordinary affairs, and for interior illumination, a question of taking into consideration the difficulties and increased expenses attendant upon the inauguration of a new system. We do not trouble ourselves with calculations, which often render impossible the application of certain innovations. It very often happens, in the case of lighting a large warehouse or public place with gas, that we spend ten times more than is really necessary, in the hope that, as a result, we shall draw more customers, or attract the public in greater numbers, and thus amply compensate ourselves for the outlay originally incurred. But we very much doubt whether, even under these special circumstances, when once the charm of the electric light had worn off, it would seriously affect gas.

"To produce the light, and to illuminate, are two very different things," observed M. Camus, a Director of the Paris Gas Company, in an interesting work on the electric light and lighting by gas. Long before the discovery of gas, Lavoisier pointed out what he considered to be the criterion of good lighting for streets and habitations. It was this: To have a large number of light-centres, each possessing a considerable area of illumination, but of small luminous intensity. Number is useful for the realisation of a regular illumination of the objects on all sides, and for destroying shadows; area, for obviating fatigue to the eye. Experience has demonstrated that the division of the electric light (we cannot foretell what progress may be effected in this respect in the future) is much less economical than its concentration. But, on the other hand, this concentration of the light would be inconvenient for house and street lighting, for which purpose a number of small dispersed lights are required, rather than a brilliant concentrated

one. Such great luminous intensity being unbearable, recourse must be had to globes or other means of toning it down, and these, in diminishing the redundant luminosity, would at the same time, to a certain extent, nullify the advantages to be derived from the production of a light of very high illuminating power. Little by little, therefore, we should, by dividing the electric light, arrive at results altogether incompatible with its fundamental properties.

It is not, therefore, to the division of the electric light—which, whatever may be effected, will not be comparable with the divisibility of gas—that we must attach importance, but rather to the obtainment of favourable effects by its concentration; that is to say, the production of isolated light-centres of great luminous intensity. If we are desirous of employing the electric light to the best advantage, we must necessarily restrict its use to the illumination of extensive areas, and the light must proceed from an elevated position; while gas, divisible almost to infinity, easily regulated whenever and wherever it may be in use, and giving out more or less light according to requirements—gas, we repeat, may be employed in every case in which the numerous inherent complications of electric lighting would render a practical and continuous application of that system impossible.

To sum up, we may with certainty infer that the progress made during the past few years in the use of electric lighting has in no way increased its chances of becoming a competitor with gas. On the contrary, it has rather served to prove how limited and exceptional are the uses to which that kind of illumination may be applied, and the impossibility of its competing economically with the now generally-adopted system. It is, as we have said, a luxurious method of providing light, and cannot in any way be prejudicial to gas lighting. The electric light is undoubtedly one of the most interesting features—the complement, so to speak—of the special science of which it forms a part; but its very nature and properties prevent, from a practical point of view, its development to any very great extent.

With regard to the sensational accounts that reach us from America on this subject of the electric light, they all bear, in such a high degree, the stamp of exaggeration, that we may pass them by without examination.

Let the shareholders in gas companies, then, rest perfectly easy. As far as regards the present position of the technology of electricity, they have nothing to fear, and no danger, either near or remote, seems to us, for the moment, to threaten their interests.

The following is an abstract of an exhaustive article on this subject which appeared in the *Journal für Gasbeleuchtung*:—

The electric light itself is almost as old as gas light, but it is only within the past few years that it has assumed any practical importance; since, in fact, we learnt how to produce the current at a relatively small cost; to produce a constant light up to a certain degree; and, lastly, to divide the light. At the period of the Vienna Exhibition, the lighting of streets and the interiors of buildings by electricity in place of gas was far from people's thoughts; but in the few years that have elapsed since that time, the idea has not only been conceived, but carried out on a somewhat extensive scale in Paris. [The article then describes in detail the numerous applications of the electric light that have recently taken place in Paris, and the various electric machines employed in generating the currents. Reference is then made to the important discovery made by Jablochkoff of the divisibility of the light, whose electric "candle" is supposed to be equal to 100 of the Paris gas-burners, each consuming about 5 feet per hour. But the writer points out that the light produced by 100 burners concentrated at one spot, and the same number distributed over a given area, is very different, and states that experience has proved that an electric light of this power will only produce the same amount of illumination as 30 gas-jets, and in many cases only between 20 and 30.] The circumstance that it is possible with a single electric machine to supply simultaneously a large number of these candles with electricity, is partly owing to the arrangement of the machine, and partly to the special property of the candle. This property renders it possible to supply from one and the same circuit at least four lamps, each farther removed than the other from the source of the current. The wire that conducts the electricity to the first lamp serves to carry it on to the second, and so on through the series; the wire from the last lamp only returning to the machine.

The improvement in the electric machines consists in their not producing, as hitherto, a single current, but several currents independent one of the other, so that each may be used for the supply of one or more candles. In the lighting of the Avenue de l'Opéra in Paris, for instance, three machines were employed, each furnishing four independent currents, for the supply of the 48 lamps used.

This being the present position of electric lighting, technically considered, we are in a position to express some kind of opinion relative to the question of its practical application. In the case of large areas, for the illumination of which a large number of gas-jets has hitherto been required, it is certainly possible to replace gas by the electric light. There are, however, two technical difficulties in connection with this light. The first is, seeing that the light issues from a single spot, the difficulty of distributing it to all parts of a workshop, for instance, in such a manner as to be most advantageous for the work carried on therein. There must be nothing in the place likely to produce a deep shadow, and the workpeople must be so located as not to be in their own light. With gas, however—such is its wonderful adaptability to all requirements—any part of the place may be illuminated to whatever extent may be desired. In order to obtain a better distribution of the electric light, reflectors have been tried, as well as the projection of the light against a whitened ceiling; but this, it is unnecessary to state, has always resulted in loss of light. For lighthouses, large open spaces, docks, railway stations, theatres, and halls (in place of the chandeliers, sun-lights, or lustres, now used), manufactories, and large warehouses, the electric light seems applicable; and we should be deluding ourselves if we were to shut our eyes to the fact that in such cases as these the new light will undoubtedly compete with gas.

The second difficulty consists in the want of security from possible interruption in the supply of the light. First of all, some change may take place in the points of the carbons, on the integrity of which depends the regularity of the light; and there may be some interruption of the regular working of the electric machines. Then, the light cannot be made in advance and stored for use, like gas; it has to be produced when it is required, and the moment the machine stops the light goes out.

Setting aside these difficulties, there is the question of cost. Of course this is a subject very much discussed at the present time, and parties interested in the supply of electric machines undoubtedly try to place the matter in the most favourable light; but, according to calculations made by M. Oechelhaüser, the General Director of the German Continental Gas Association—calculations which have not yet been refuted, but have rather been confirmed on several points—the cost per hour of a supply of electric light equal to about 100 gas-jets for 500 hours annually would be about 1 fr. 69·5 c. (1s. 5d.), and for 4000 hours 78·8 c. (7·88d.). This, however, is reckoning the electric light as being equal to 100 gas-jets; but it is, in fact, only, as we have said, equivalent to some 20 or 30—say 25—and these, burning the quantity of gas usually consumed in the public lamps of Paris, charged at the price paid in Munich, with abatement, would cost 87·4 c. (8·74d.) per hour. On 4000 hours lighting there would, however, be some reduction; but, even under the most favourable circumstances, the electric light could not recommend itself as being cheaper than gas.

One property of the electric light may, in certain cases, plead in its favour, and that is its almost perfect immunity from the risk of fire; and to this may be added its other quality of generating but little heat. But if we ask whether the electric light is suitable to replace gas for the general illumination of streets and ordinary private dwellings, the question must certainly be answered in the negative. The electric light used in the trials that were recently made in Paris cost the Municipality more than double what they would have paid for gas; and when other inconveniences attending the employment of this light out of doors are taken into consideration—among them the necessity for sending a person to replace the consumed carbons—no one will think seriously that the present system of illuminating the streets can ever be superseded by electric lighting.

Still more absurd would it be to suppose that such a substitution could be effected in the case of ordinary private lighting. As a general rule, we do not require, in our private houses, a lighting power equal even to the smallest electric lamp. The clear light of a good gas-flame answers all purposes. The adoption of the electric light in ordinary dwelling-houses would put consumers to the greatest inconvenience. In order to obtain the light, the engine would have to be started, the candles placed in position, and the circuits and mechanism generally kept in good order, all which, especially the latter, must be attended to by a skilled workman. It is useless to think of fitting up all the machinery in a single station, like a gas-work; each consumer, or at the most a few neighbours, must have his own engine and electric machine. The gas consumer, on the other hand, has only to turn on his tap, apply his taper, obtain his light at any hour of the day or night he pleases, and leave it burning as long as he thinks fit, without having to trouble himself any more about it. There is nothing more convenient than gas, and experience has proved that, over and over again, that source of light has been preferred; even at those times when other illuminating materials—petroleum, for instance—have really been obtainable at cheaper rates. Let us, just for a moment, imagine that to illuminate a large city by means of electricity 10,000 electric lamps, motive power equal to 10,000 horses, and no doubt 1000 machines for generating the currents, with the necessary network of circuits for their distribution, would be required, and that all the mechanism would have to be set in operation and superintended by skilled workmen—let us imagine all this, and it seems almost ridiculous to believe in the possibility of the electric light ever being in a position to supersede gas for ordinary private illumination, even supposing the time should arrive when it can be produced at a very much lower rate than is possible at the present day.

ON SOME IMPROVED METHODS OF PRODUCING AND REGULATING ELECTRIC LIGHT.

By Mr. Henry Wilde.

[A Paper read before the Manchester Literary and Philosophical Society, Oct. 29, 1878.]

Among the manifold functions which the elementary substance, carbon, performs in organic nature, not the least important is that by which it becomes the great source of artificial illumination, whether derived from oils, coal gas, or from coke rendered incandescent by the action of powerful electric currents. Since the time when Davy first produced the voltaic arc between two points of wood-charcoal, through which was transmitted the current from the great battery of 2000 plates belonging to the Royal Institution, many experiments have been made to determine the best kinds of carbon for developing the electric light. The carbon which, until recently, was most commonly employed for this purpose is obtained from the sides of gas-retorts, where it accumulates, in the form of coke, during the destructive distillation of coal. The shells of coke from the retort are sawn up into pencils, from one quarter to half an inch square, and from 6 to 9 inches in length. Although very good results are obtained from carbon of this kind, it is a difficult material to work, on account of its hardness, and it sometimes contains impurities which interfere with its conductivity. It is also liable to fracture when suddenly heated by the transmission of powerful electric currents. These defects have led to the introduction in electric lighting of artificial carbon, composed of powdered coke and lampblack, formed into a paste with molasses and gum. This material is pressed into cylindrical forms, and subjected for a given time to a high temperature in a special furnace. The manufacture of these carbon pencils has obtained great perfection in the hands of Carré, of Paris, and they can be made into perfectly straight and cylindrical forms of from 2 to 16 millimètres in diameter and half a mètre in length.

When the electric light is to be used for illumination, it is necessary that it should be as continuous as other modes of lighting. For this purpose, not only should the current be regular in its action, but the distance between the carbon points must not alter, which necessitates the use of some arrangement for bringing them nearer together in proportion as they are consumed. Much ingenuity has been displayed by electricians in solving this problem, and the automatic contrivances invented by Staite, Duboscq, Foucault, Serrin, and others, leave little to be desired in regard to the steadiness of the light, when the regulators are in good order and in the hands of intelligent operators. All automatic instruments, however, from the delicacy of their mechanism, are liable to derangement, and their action is not easily understood by persons not having a special knowledge of their construction. To obviate the objection to the use of such instruments by unskilled attendants, I devised, a few years since, a regulator for use on H.M.'s ships of war, to be actuated by hand. In this arrangement the carbons are made to approach and separate from each other by means of a right and left-handed screw connected with the carbon holders. Each of the screws, with its carbon holder, can be actuated independently of the other, for the purpose of adjusting the points of the carbon to the proper focus of the optical apparatus used in connection with it. The regulator, with its carbon points, is placed in the focus of a dioptric lens, which parallelizes the divergent rays of light into a single beam of great intensity. The lens with the regulator is pivoted horizontally and vertically on the top of a short iron column, fixed on a raised platform above the deck, and the beam of light may be projected upon any distant object within its range. This special application of the electric light, however, as will be seen, requires the frequent adjustment of the carbons by the operator; but as he is always required to be in attendance to manipulate the projector, no inconvenience is experienced through the absence of the automatic arrangement. This method of regulating the electric light has now been in use in the Royal Navy for more than three years, and has proved very satisfactory.

Simultaneously with the progress of improvements in the mechanism for regulating the electric light, experiments have been made with the object of dispensing with the regulator altogether. The most recent, as well as the most successful of these attempts has been made by M. Jablochkoff, a Russian inventor. In the specification of his letters patent of 1877, he proposes to place the carbons side by side (as had been previously proposed by Werdermann in 1874), and to separate them by an insulating substance to be consumed along with the carbon. The inventor states that the insulating substance for separating the carbons may be kaolin, glass of various kinds, alkaline earths, and silicates, which he

prefers to apply in the form of powder rammed into an asbestos cartridge case containing the carbons. A powder which the inventor found serviceable consists of one part lime, four parts sand, and two parts talc. These materials are rammed into the cartridge case surrounding and separating two parallel sticks of carbon placed in the case at a little distance apart. One of the carbons is made thicker than the other, to allow for its more rapid waste. The lower ends of the carbons are inserted into pieces of copper tube or other good conductor, separated from one another by asbestos, and the ends of the tubes are pinched between two limbs of a screw-vice, connected respectively to the conducting wires. This combination of carbons and insulating materials, the inventor terms an electric "candle," which, when mounted on a stand or candlestick, has the appearance of the Roman candle of pyrotechnists. The inventor further states that the heat produced by the electricity fuses the material between the carbons, and dissipates it; and the freedom of the passage afforded by the fused material to the electric current permits the subdivision of the light by placing several lamps in the course of one electric circuit. It is also stated that the construction of the candle may be varied; and, among the forms described, is one in which the carbons, instead of being contained in a cartridge case, are separated by a partition of kaolin or other similar insulating material.

I have thought it well to describe, as nearly as possible in the words of the inventor, the electric candle which is now the subject of so much attention in its application to electric lighting, so that its relation to what follows may be more clearly perceived. A remarkable peculiarity of the direct current in electric lighting is that of its consuming the positive carbon at twice the rate of the negative one; and while the negative carbon is a pointed cone, like that of a pencil, the positive pole takes the form of a hollow cavity or crater.

M. Jablochkoff's early experiments seem to have been made with the direct current, and hence his carbons are described as being of unequal thickness in order that the positive and negative carbons of the candle might be evenly consumed. When the alternating current is used for producing electric light, both carbons are of the same thickness, and are consumed at an equal rate, and both points terminate in regular cones. This property of the alternating current, besides other advantages, always maintains the luminous point in the focus of any optical apparatus used in connection with it—that is, when the carbons are placed end to end, as I had occasion to point out in a former paper read before the Society in 1873, "On an Electro-Magnetic Induction Machine for Producing Alternating Currents."

M. Jablochkoff, in the course of his experiments, would appear to have met with some difficulties in adapting the direct or continuous current to a system of lighting with his electric candles, and now uses the alternating current for this purpose. The candle has also been simplified by substituting a slip of plaster of Paris for the cartridge and partition of kaolin formerly employed.

To produce the alternating currents, however, to supply a number of lights, it was found necessary to employ powerful electro-magnetic induction machines, excited by the currents from other smaller machines, according to the principles laid down in my paper read before the Royal Society, and published in the "Philosophical Transactions" of 1867. From 16 to 20 lights are produced from one of these electro-magnetic machines, each light absorbing about one horse power.

The system of electric lighting above described would now seem to be definitely established in some places as a substitute for gas, and visitors to the French capital during the present summer will have been struck with the fine effects produced in the avenues and squares where the light is displayed.

My connection with the history of this system of lighting placed me in a position to make some experiments with the Jablochkoff candle, and led to the discovery of the following facts:—One of the conditions necessary for producing a constant light from the candle, in its most recent form, was that the quantity and intensity of the alternating current should be such that the carbons consume at a rate of from 4 to 5 inches per hour. If the electric current were too powerful, the carbons became unduly heated, and presented additional resistance to the passage of the current; the points, at the same time, lost their regular conical form. If, on the other hand, the current were too weak, the electric arc played about the points of the carbons in an irregular manner, and the light was easily extinguished by currents of air.

In the course of these experiments, I was struck with the apparently insignificant part which the insulating material played in the maintenance of the light between the carbon points, and it occurred to me to try the effect of covering each of the carbons with a thin coating of hydrate of lime, and mounting them parallel to each other in separate holders, and without any insulating material between them. The use of the lime covering was intended to prevent the light from travelling down the contiguous sides of the carbons. On completing the electric circuit, the light was maintained between the two points, and the carbons were consumed in the same regular manner as when the insulating material had been placed between them.

Two plain cylindrical rods of carbon three-sixteenths of an inch in diameter, and 8 inches long, were now fixed in the holders parallel to each other, and one-eighth of an inch apart. The strength of the alternating current was such that it would fuse an iron wire 0·025 of an inch in diameter and 8 feet in length. On establishing the electric current through the points of the carbons, by means of a conducting paste composed of carbon and gum, the light was produced, and the carbons burnt steadily downwards as before.

Four pairs of naked carbons mounted in this manner were next placed in series in the circuit of a four-light machine, and the light was produced from these carbons simultaneously, as when the insulating material was used between them. The light from the naked carbons was also more regular than that from the insulated ones, as the plaster of Paris insulation did not always consume at the same rate as the carbons, and thereby obstructed the passage of the current. This was evident from the rosy tinge of the light produced by the volatilization of the calcium simultaneously with the diminution of the brilliancy of the light from the carbons.

The only function, therefore, which the insulating material performs in the electric candle, as shown by these experiments, is that it conceals the singular and beautiful property of the alternating current to which I have directed attention.

As I have already said, the strength of the alternating current must bear a proper proportion to the diameter of the carbons used, and when a number of such lights are required to be produced in the same circuit, the quantity and property of the current will remain constant, while the tension will require to be increased with the number of lights.

This simple method of burning the carbons will, I believe, greatly further the development of the electric light, as the carbons can be used of much smaller diameter than has hitherto been possible. They may also be of any desired length, for as they are consumed, they may be pushed up through the holders without interrupting the light. One of these developments will be a better method of lighting coal and other mines. In this application, the alternating currents or waves from a powerful electro-magnetic induction machine may be used for generating, simultaneously, alternating secondary currents or waves in a number of small induction coils, placed in various parts of the mine. The light may be produced in the secondary circuits from pairs of small carbons enclosed in a glass vessel having a small aperture to permit the expansion of the heated air within. Diaphragms of wire gauze may be placed over the aperture to prevent the access of explosive gas. By generating secondary currents or waves without interrupting the continuity of the primary circuit, the contact breaker is dispensed with, and the subdivision of the light may be carried to a very great extent.

AMERICAN GASLIGHT ASSOCIATION.

[Condensed from the "Official Report" in the *American Gaslight Journal*.]

(*Continued from page* 897.)

Mr. J. S. CHAMBERS (Trenton, N.J.) read the following paper on

WATER GAS.

The making of illuminating gas by the decomposition of water, with an admixture of petroleum or its products, is a subject that, more than any other connected with our business, has claimed the attention of the Managers of Gaslight Companies for several years past. It was a topic in existence at the time of the organization of this Association, and year by year came up for discussion at its meetings. At the meeting in October, 1876, the Association, after a long debate, seeming to have become weary of the matter, abandoned its further consideration. It may now, after the lapse of two years, be not amiss briefly to consider the progress that has been made, and, as far as possible, judge what success has attended the efforts of those who are earnestly trying, by this mode, to improve and cheapen artificial light.

With the origin, progress, and present attainment of the coal gas manufacture, you are all familiar. Let us now as briefly as possible review the past history of efforts in the manufacture of what we may call in a general way "Water Gas," and thus put ourselves in a position to understand the progress that has been made.

The first experiments in the manufacture of water gas were made in England about the year 1823.

In a report made to the Manhattan Gaslight Company, of the City of New York, in the year 1864, by Professors John Torrey, Carl Shultz, and Henry Würtz, is enumerated a list of 60 patents, for plans and devices of water gas apparatus, of various dates, during a period of 36 years, from 1823 to 1859.

Mr. Hughes, in his treatise on gas-works, third edition, states that, about 1854, the hydrocarbon or water gas process was in great favour in England, and very sanguine expectations existed of its success; and that among its supporters were the celebrated Dr. Frankland and Mr. Samuel Clegg. Mr. Clegg's estimate was that 75,000 feet of 12-candle gas could be produced from one ton of Boghead coal, when submitted to water gas treatment.

The towns of Ruthin, Southport, Warminster, and Dunkeld, were lighted with the gas, and a number of companies, among them the Manchester and South Metropolitan, made trials of the system on an extensive scale. The results in all these cases failed to be satisfactory, and the operations were abandoned.

Among the numerous patented devices for producing water gas at that time, was one by a French chemist, M. Joseph Pierre Gillard. His invention is thus described by Mr. Hughes:—"With the view of obtaining hydrogen more economically, M. Gillard erected a cupola similar to those in iron foundries; this was filled with coke or charcoal, ignited, and the fuel brought to a state of incandescence by a fan or blower; after which (all passage to or from the atmosphere being closed), steam was admitted at the lower part, and, passing through the volume of fuel, was decomposed, when the hydrogen and carbonic acid, with which it was impregnated, were withdrawn by an exhauster from the upper part of the cupola. From time to time the supply of steam ceased, and air was furnished by the blower as before, to bring the fuel to the proper degree of temperature for the decomposition." It is easy to recognize, in this cupola, the present "Lowe" gas-generator. From 1834 to 1839 extensive experiments were made upon the continent of Europe with the process of M. Jobard. The towns of Dijon, Strasburg, and Antwerp, and two districts of Paris, were supplied with gas made under his patent. It was claimed that by this process 55 cubic feet of highly brilliant gas could be produced from each pound of resinous or mineral oil, capable of yielding alone only 7 feet. After five years of trial the plan failed.

In 1860 an effort was made to introduce the manufacture of water gas, under the "Sanders process," into the Philadelphia Gas-Works. The carbonaceous material in this case was resin. The owners of this patent proposed to make this gas equal in every respect to the gas ordinarily made at the city gas-works, at a cost of 30 cents per 1000 feet. Experiments made at the gas-works were not successful. The promoters of the process charged the Chief Engineer of the city works with obstructing its success, and a violent controversy arose, which was carried on through one of the newspapers for nearly three months. At length a small works was built at one of the hotels, and a part of the building lighted with the gas.

A few extracts from the newspapers of that day will show the flattering estimate placed upon the gas.

From the *Philadelphia North American and United States Gazette* of July 31, 1860:—"The Water Gas.—A Brilliant Light at the Girard House.—These lights were commenced three weeks ago. Some days elapsed before the tar produced by the coal gas was cleared out of the pipes; and now we have this wondrous discovery, the water gas, in all its glory, diffusing light and cheerfulness everywhere around. Its influence extends far and wide, for the brightness is of a white, clear, pure, and penetrating character, before which even distant darkness flies away. One great advantage, too, is its cheapness; the price being much less than that of the gas made from bituminous coal. The economy is derivable—first, from the superior productive power of the retorts. Second, from the decreased proportion of labour. Third, from the decreased capital required in original construction. Fourth, from the decreased cost of gas material. A reduction of four-fifths in cost of material, transportation, and labour will doubtless secure its introduction into many regions now but partially supplied with this great agent of social progress, enlightenment, and comfort."

From the *Public Ledger*:—"The quality of the gas appears to be good, giving a strong and brilliant light. Those interested in its manufacture, state that the actual cost of its manufacture, exclusive of labour, wear and tear of retorts, &c., will not exceed 28 cents per 1000 feet."

From the *Evening Bulletin*:—"A more brilliant light than that seen every evening from the burners supplied from this source, could not be desired. The proprietors of the Girard House are already satisfied that it costs much less than the gas furnished from the city works."

Correspondence of the *New York Tribune*:—"It has been demonstrated that this gas can be produced at 40 cents per 1000 cubic feet."

Notwithstanding the encomiums so freely bestowed upon the gas, it made no further progress in Philadelphia, and soon disappeared.

The files of the *American Gaslight Journal* for the years 1861 and 1862 contain much discussion on the subject of water gas. Then for a few

years not so much was heard about it, though new inventions were preparing to enter upon the scene. A new ally was also found in the natural oil from the wells of Pennsylvania, which, by affording cheap material for enriching the water gas, raised the expectations of inventors, and incited them to renew their efforts.

In 1874 several patented processes were brought to the notice of gaslight companies, and their merits urgently set forth. Prominent among those was the one known as the Lowe process, and it is in regard to this process I now propose to give such facts as are in my knowledge.

At the outset, let me state what the process was claimed to be able to perform, and I can perhaps best do this by extracts from letters received from an agent.

"Presuming that you have an average daily consumption of 100,000 cubic feet at a cost of 1 dol., the result would be 100 dols.

	Dols.
By the Lowe process it would be	26
Showing a daily saving of	74
Or per week	444

"But this only shows the saving in the first cost of the gas. The subsequent saving in labour would be very great; I cannot even guess how much. Two men or well-grown boys would be able to do all the work. By this process there is absolutely no residuum, no *débris*, no lime, no coal tar, no dust, no dirt, no drips—nothing, in short, but to make money quietly, pleasantly, and acceptably to the public whom you serve. . . . You could dispose of nine-tenths of your real estate, all of your retorts, &c., and divide 25 to 50 per cent. per annum."

Speaking of works then in operation, the agent wrote: "The townspeople are delighted, the gas is magnificent, and applications to introduce it are thronging in, very much to the satisfaction of the Company."

Reducing these enthusiastic and somewhat incoherent statements to a plain matter-of-fact standard, their claim is, that gas can be produced of as good quality, at a much less cost, and with a smaller outlay for works, by the mode proposed, than can be produced by the coal method in common use. Let us now try to ascertain how far these expectations have been realized.

It is unnecessary for me to narrate the steps by which, in December, 1877, the Trenton Gaslight Company found themselves the owners of gas-works built exclusively for the purpose of making this gas. The works were put into operation in December, 1876, and by the December following had obtained about 350 consumers.

The works and apparatus consisted of a generating-house, 40 by 35 feet, containing one steam boiler and engine, two trains of apparatus, each consisting of a generator, superheater, wash-box and scrubber, a holder, street mains and consumers meters, together with the necessary oil and coal storeage.

The illuminating quality of the gas, though attended with some irregularity, has not been a matter of serious complaint. It is in the power of the gas-maker to increase or diminish the quality of the gas by using more or less oil; and hence, by skill and care, a good illuminating power can be commonly maintained.

In two respects, however, the gas proved to be unsatisfactory to many of its consumers. One was the stopping up of the tips of the burners with a pitchy or a hard deposit, which rendered it necessary to frequently clean out or renew the burners; and in some instances, the house-pipes became clogged. The other was its peculiar offensive odour.

For these reasons many of the consumers applied to be changed back to the coal gas, and from December, 1877, to July, 1878, 87 consumers were, at their own request, thus transferred. During the same period there were no new applications for the introduction of the water gas.

In view of this result, it must be conceded that this gas is not as acceptable to consumers as gas from coal.

The only measurement of the gas from this works is by the consumers meters. Hence, any calculation of its cost must be upon the amount of gas sold—the unaccounted-for gas being an uncertain element of cost.

For the quarter ending Dec. 31, 1877, there was sold of this gas 2,600,000 cubic feet.

	Dols.	cnts.
There were used in making 14,930 gallons of oil, at 8½ cents (1269·05 dols.), 246,240 lbs. of coal, at 20 cents per hundred (492·48 dols.); being for material . . .	1761	53
There was paid for wages	591	50
Making total cost	2353	03
Being at the rate of . . . . 90·5 cents per 1000 feet.		
Or—For oil and coal . . . 68·0 ,, ,,		
For wages . . . . . 22·5 ,, ,,		

For the quarter ending March 31, 1878, there was sold 1,592,000 cubic feet.

	Dols.	cnts.
There was used in making 9019 gallons of oil, at 8 cents (721·52 dols.), 150,140 lbs. of coal, at 17 cents per hundred (255·23 dols.); being for material	976	75
There was paid for wages	523	50
Making total cost	1500	25
Being at the rate of . . . . 94·9 cents per 1000 feet.		
Or—For oil and coal . . . 61·4 ,, ,,		
For wages . . . . . 33·5 ,, ,,		

The whole amount of gas sold from the starting of the works in December, 1876, to July 1, 1878 (being a period of a year and a half), was 9,704,000 cubic feet.

The amount paid for making was—

	Dols.	cnts.
For oil	4701	25
For coal	1665	05
Being for material	6366	30
And for wages	2445	00
Making total cost	8811	30
Being at the rate of . . . . 90·8 cents per 1000 feet.		
Or—For oil and coal . . . 65·6 ,, ,,		
For wages . . . . . 25·2 ,, ,,		

A further item of expense, which is peculiar to patent gas, must be added to this cost, for the royalty to be paid for the right to manufacture, or for the purchase of the patent.

These three statements are sufficiently near each other in proportions to show a good degree of regularity in working, and are submitted, not as good or bad in themselves, but as facts of practice.

Any gas manager, by taking the same data, can compare these results with his own, and judge whether the promise of much lower cost has been fulfilled. The claim of smaller outlay for building works is hardly worthy of consideration.

The two sets of generating apparatus in the works under review have each a productive capacity of about 70,000 feet in 24 hours—being for the two 140,000 feet in the same time. Upon about the same space could be built four benches of retorts, of modern construction, capable of producing an equal volume of gas. Should purification be adopted, equivalent buildings in that department must be constructed. In no other part of a works could there be any comparatively less construction.

If the results of the experiment which have now been laid before you are fair, it must be acknowledged that coal gas still holds its place in the advance, and that water gas, after half a century of effort, has not yet overtaken it.

It is to be regretted that the skill of inventors has not been able to bring about results equal to their desires. By none would a large reduction in the cost of making gas be hailed with greater pleasure than by the members of this Association. It is the hope of improvement which brings us together, and makes this Association possible. It is our product that chiefly concerns us, not the material or the means through which it is obtained. It is the satisfaction of our customers and employers for which we strive, not the promotion of this or that process or invention.

The careful manager should be swayed neither on the one hand by prejudiced indifference, nor on the other by unreasoning zeal. While diligently seeking improvement, he should look with distrust on plans and schemes heralded forth with bragging boastfulness. "Oft expectation fails; and most oft there where most is promised." Let us then "Prove all things; hold fast that which is good."

THURSDAY, OCT. 17.

Mr. CHARLES H. NETTLETON (Derby, Conn.) read the following paper on

SELLING GAS.

In this paper, which I propose to present, I have departed somewhat from the usual course taken in the selection of subjects. I think all the papers which have been read before the Association have treated, in one form or another, of the manufacture of gas, and it is fitting and proper that it should be so, as we are an Association of Gas Engineers. But most of those present occupy also the position of managers, and to them, in that capacity, I would particularly address myself in this paper on the selling of gas.

Before proceeding with my subject, I desire to state that the views advanced in this paper are the conclusions arrived at by personal management of small gas-works in New England, and are not mere theories, having no local habitation except in the brain of the writer. That they do not apply to large, or even medium-sized works, I am confident; but of their application in the working of small works there is not the slightest doubt in my own mind.

I believe it is an admitted fact that gas companies, of all concerns dealing with the general public, are the most cordially disliked. The reasons we assign for this are almost too well known to be repeated here. The inherent nature of the business, dealing with a commodity which has to be measured in a blind way, and which is not readily understood by a jealous public, make our business a very difficult one in which to satisfy our customers. This we state broadly and repeatedly, and this, I think, most of us believe. But are we not deceiving ourselves when we say this? Is it not possible that we are ourselves to blame, in some measure, at least, for the distrust with which we are regarded, and for the dislike that many have for us? The mere witticisms that are so common—"You lie like a gas-meter," "Don't ask that brother to pray, because he is the president of a gas company," and the like, show to me a state of feeling in the public mind for which we are largely to blame.

I am firmly convinced that the course pursued in selling gas, as it is generally practised, is radically wrong. If we gave the same time and thought to that which we give to the manufacturing of our gas, I believe where pennies are saved now, dollars, almost, could be saved then. In treating of the selling of gas, I would divide it into three parts: The means adopted to obtain new consumers; the treatment of them when obtained; and the introduction of appliances for the use of gas other than for illumination.

First, as to the means adopted to obtain new consumers. I hold it to be the duty of every gas manager to look for new customers as earnestly as he tries to reduce his leakage or increase his yield. A list of persons, on the line of pipes, who can afford to use gas, and who do not, should be prepared, and, if a possible thing, seen by the manager himself and asked to become consumers. With some, a very slight urging will bring the desired result; with others, the change can only be brought about by repeated and repeated visits. Often a man will hesitate because of the expense of piping his building; and this is not to be wondered at, when it is considered that in having such work done he has to employ a set of men whose name is almost synonymous with excessive charges and big bills. In that case the manager should name him a price at once, to include service, setting meter, and piping; and, if necessary to obtain the customer, do the work 10, 15, or 20 dols. less than cost. I know of no better way to invest either of those sums, if by so doing I can add one to the list of my consumers. It may be said that such a course would make the service account a source of great expense. But would not great benefit be derived? What company could not afford to spend 1000 dols. or 2000 dols. for 100 consumers? The money would be back in the treasury in one or two years, and from that time the company would have the benefit of the extra consumption.

I have heard of a town in Michigan where the Gas Company run, at their own expense, the service-pipes into buildings and then furnish fixtures at cost. I commend the action of that Company to your careful consideration.

Again, where a consumer has left you and put up lamps, unless he be a poor, miserable fellow, it is good management to make repeated attempts to bring him back. Personally, I am never tired of asking those who have left me to come back to the true faith; but to do this successfully, you must not let your consumer leave you at the end of a quarrel. By a little patience and perseverance you can almost always induce a customer, in leaving, to make some remark like this—that he is "sorry to give up the use of gas, but he cannot afford it." That leaves the matter at a point where you can see him again on the slightest pretext, and ask him to use gas once more.

I hold that, in doing this, neither you nor the company you represent lose your dignity in the least. I regard the selling of gas like the sale of any other commodity. We make it and have it for sale, and if the people will not come to us and buy, is it not best to go to them and sell?

Less than two years ago, the engineer of a large company in a city not a thousand miles from here, where the loss of consumers had been very great, made this remark to me: "There is a large number of people in our city who are anxious to give up oil and use gas again, and are only waiting to be asked; but we shall never ask them to come back. If they ever use gas again, they must do so of their own free will."

Supposing any of the merchants of this city attempted to do their business on similar plans, how long a time could they keep their doors open? Or how long a time would a travelling agent retain his position, if he, in selling, merely went to a city, sent out his cards, and waited for customers to call on him?

I am positive gentlemen, that we make a mistake in doing little or

nothing to gain new consumers, or regain those we have lost. It is our good fortune that in ordinary times the number will increase without our aid; but how much faster would it increase if we only put the same push and energy into our business that others are obliged to put into theirs in order to live!

As to the treatment of consumers when obtained. A gas manager should always be polite in meeting his consumers, and never, no matter how great the provocation, lose his temper; never be too tired to explain how the bills in September are naturally larger than in August, or those in October larger than in September; never be in so much of a hurry but that he can show how a meter works, never so impatient that he cannot listen to every complaint, and never so busy that he cannot attend to all the wants of his customers.

He naturally meets them oftener when the bills are paid than at any other time. Do not receive the money as if it was conferring a favour on them to take it, but as if you knew it was a favour to your Company that they paid it. A kind and pleasant word spoken then will often smooth away a frown, and your consumer, very likely, will go out of the office thinking the Gas Company is not such a bad institution after all.

But a man comes in bristling all over, and accuses you of selling poor gas, with oaths and adjectives thrown in not complimentary to your Company. The impulse with every one is to resent it; but what good will that do? If the accusation be true, own it; explain how it happened, and your consumer is disarmed. If it be false, convince the man of his error, and do not let it pass as trivial. Show a man once that he is mistaken, and he will be chary about saying imprudent or impolite things a second time.

Again, a customer tells you that he knows his meter is wrong, that all meters lie, and his is the worst of a bad lot. First, tell him his meter may be wrong, that it shall be tested, and invite him to be present when it is done; and then convince him of his error in regard to meters in general. Show him your glass meter, explain its workings, and my experience is you will never hear from that man again.

I have seen on the walls of a gas company's office, in a neighbouring city, a lithograph of a man being carried away on a stretcher, and labelled "The man who was talked to death." It was the habit of the office, as the clerk informed me, when a consumer commenced to scold about his bill, to point to that picture and say nothing. Gentlemen, supposing the case to be reversed, and you or I to be treated in such a manner, should we feel kindly toward that company? In my own case, much as I like gas, it would be sufficient to make me use oil.

Again, I believe it to be poor policy to tell a customer, "Pay your bill, or I will take your meter out;" and then, perhaps, remove it, as I have heard of some companies doing, in the evening, or so late in the afternoon that the man had no opportunity of purchasing lamps. If you have decided that the man is no longer to be trusted, and that his supply of gas must be stopped, go and have a talk with him; and ask him if he had not better quit for his own sake, and if possible to get him to agree to that. Then allow him to name his own time, within a day or two, when he will be ready with lamps. The man then feels he has been liberally dealt with, and often will make special efforts to pay his bill; or, if he uses oil, he tells his friends and neighbours that he cannot afford to use gas, and not that that "blank gas company took out the meter."

Again, I believe it pays to be exceedingly liberal in collections. We all sell gas to a large number of poor men—men who really cannot afford to use it—and they often would consider it a great favour if a bill could go over for a month or two. Such concessions cost the company very little, and are of great moment to the persons to whom they are granted. Often, too, by being liberal in such a matter, a consumer will be retained who would otherwise be lost. A risk is run, to be sure, of losing the bill, and with it one or two more. But I am satisfied, after trying the experiment for several years, that I have made more than I have lost by it.

To sum up all. In dealing with your consumers, be reasonable, conciliatory, and generous.

Again, I believe the consumption can be largely increased by well-directed efforts to have the gas used for other purposes than lighting. Most of us, I think, do favour gas-stoves for cooking, and try to introduce them. I presume your experience has been similar to my own—that it is very difficult to sell the stove outright, owing to the expense. I worked on that plan for two or three years, and met with only partial success. During the past summer I offered to give the use of such stoves as I had free, if persons would use them for cooking. It was not long before all were out, and it is one of the best investments my Company have ever made. I expect to continue to send out stoves, either in this way or for a mere nominal rent.

In this connection I would call your attention to the introduction of gas in factories or shops, where a small amount of heat is required, such as in soldering, heating glue, metals, and the like. Often the manufacturer has never thought of using gas for this purpose; or, if he has, he does not know how to accomplish it, or he dreads the cost, or puts it off for more weighty matters. More than once I have had manufacturers in my town, who have, at my request, tried the gas for some of these purposes, thank me for having called their attention to it.

Merely to show what can be accomplished in this line, and for no other reason, I will state that in three factories which I supply there are in use fourteen stoves for soldering, and these will consume 250,000 feet in a year. All were put in at my solicitation, and but for that I am confident my Company would have gone without that consumption for years—perhaps never had it.

Again, by strong efforts, I believe gas-engines may be introduced. At all events, in my small town I have one running, a second erected, which will be running in two weeks, and very fair prospects of selling a third. Their advantage over steam in being a perfectly steady power up to the limit of their capacity, in freedom from all care and attention, with no danger of an explosion, ought to enable us all to bring them to the favourable attention of manufacturers for small powers. Their principal disadvantage is their cost, and I sincerely trust that the gentlemen who control their manufacture and sale in this country can be induced to lower the price, so that it will bear favourable comparison with the prices of steam-engines.

Probably some of you may think my ideas visionary, vague, and impracticable. To answer this charge, if it be in your minds, and before it is uttered, I will give a few facts relating to my consumption. During the past two years, when I have been putting forth my strongest efforts in the ways I have indicated, my consumption has increased rapidly. In 1877 it exceeded that of 1876 by 32 per cent., and this year I think it will be 25 per cent. larger than last; and to this might be added the fact that electric lights have taken away almost 5 per cent. of the whole. A portion of this increase is due, I am satisfied, to the endeavours that I have put forth to extend the use of gas.

Given a small town, where it is possible for the manager to know personally almost every consumer, and let a plan similar to the one I have indicated be carried out, and I feel confident that the use of gas will be largely extended; that, when once obtained, the consumers will remain; that the bad feeling, if it exists at all, will almost entirely disappear, and, instead of being a hated monopoly, the gas company will become one of the most popular institutions of the place.

On the motion of Capt. Wm. H. White, the thanks of the Association were tendered to Mr. Nettleton for the paper read.

(To be continued.)

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is a continued push for the better classes of round coal suitable for house-fire purposes, and colliery proprietors generally have sufficient orders now on hand to keep their pits going full time. The deliveries by rail from the collieries have, however, been much delayed by the recent fogs and the heavy falls of snow in this district, and the amount of coal going away has consequently not been so large as it might have been. There has also been a pressure for deliveries on account of gas coal contracts, as the past fortnight of almost continuous foggy weather has caused a heavy demand upon the gas companies. In other classes of fuel, however, the market continues very dull, neither steam nor forge coal, burgy nor slack, meeting with any better demand, whilst the increased production of slack is causing this description of fuel to be quite a drug in the market, and stocks are accumulating. The better classes of round coal are firm at list rates, but no higher prices are being obtained, and the average quotations at the pit mouth may be given about as under:—Best qualities of round coal, suitable for house-fire purposes, 9s. to 10s. per ton; second qualities, 7s. to 8s.; common house coal, 6s. to 6s. 3d.; steam and forge coal, 5s. to 5s. 6d.; burgy, 4s. to 4s. 6d.; good slack, 2s. 6d. to 3s. 6d.; with common sorts offering at almost any price.

In the iron trade there is little or no business doing beyond a few sales for forward delivery, and sellers in some cases are willing to take contracts over the whole of next year, without any premium upon the present low prices. The quoted rates for both pig and manufactured iron are nominally the same as those last given.

The engineering branches of the iron trade are in an unsettled condition, in consequence of the reduction in wages which is generally being put in force. The boiler makers in this district are still on strike, and at some of the engineering works the men have gone out on strike against a reduction of 7½ per cent., the notices for which expired on Friday evening; but a compromise is offered, the men being willing to work at a reduction of 2s. per week, which is slightly less than that demanded by the masters.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The business of the year in the coal trade will close this week; for in the Christmas and New Year's weeks there is practically nothing done at the shipping-places. The gas coal trade of December has been very fair; so far as it has gone, the average prices of gas coals have been unchanged over the year—viz., 7s. best, and 6s. a good seconds. There has scarcely been a difference of 3d. per ton. There have been hindrances to shipments this month from the effects of the weather—gales and fogs principally; but shipments of gas coals have been fully an average over the year. Through the activity of steamers, the gas-works have been very well supplied with coals, at a rate of freight which will have averaged over the year from 4s. 9d. to 5s. a ton for steamers, and from 5s. to 5s. 6d. for sailing vessels to London, or, probably, a little less. There is not much reason to believe that these figures will be exceeded in 1879. There have been fair shipments of English gas coals abroad during the year, especially of best qualities. There has been a pretty good demand for gas coals, too, from the Irish ports in December, especially Dublin, Cork, and Limerick. There seems to have been less than the usual number of contracts entered upon this month for gas coals to deliver over next year. It is likely that there will be a more active business done in that direction after the New Year.

The forge and steam coal trades are doing pretty well. The steam coal trade is getting on better than could be expected.

Very little business in the way of chartering was entered upon in the coasting trade last week. There were fewer ready sailing vessels available; rates were high in consequence. Freights for sailing ships to load for London did not get below 7s. per ton; steamers rates were pretty still as well. There will be no great amount of detention in vessels loading gas coals during the holidays. That has been provided for. The weather is likewise settled at sea. Steamers are therefore making their passages more quickly and more regularly.

The general manufacturing trades of the North of England are extremely dull; but they are no worse than they have been for the four or five weeks last past. Iron and chemicals are very low in price. At this season of the year there is little demand for fire-bricks, cement, and that class of goods. The market is very well supplied with lead, mainly Spanish, as, from the depressed state of the market, the Weardale and Teesdale lead mines have been working very little lately.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

With the view of having their management of the gas supply undertaking conducted upon the most approved system, the Peterhead Town Council, now that they have the local gas-works in their own hands, have appointed a thoroughly capable man as their works manager—namely, Mr. Robert Smith, of Darlington, where he has been for several years engaged as an assistant to his uncle, Mr. William Smith. It may be remembered that he is the same gentleman who gained Mr. Stewart's prize of £10 for the paper on the best arrangement of gas-works, read at the St. Andrew's meeting of the North British Association of Gas Managers held last July. Mr. Smith is, I understand, also to be the Manager of the Peterhead Water-Works.

On Friday week a meeting was held at Insch, in Aberdeenshire, in connection with a proposal to form a new gas company—Provost Martin in the chair. A provisional Committee, consisting of influential business men, was appointed to get a valuation made of the present gas-works, and generally to carry out the proposal. It is stated that upwards of 250 shares have already been subscribed for. It is evident that the electric light scare has not produced much effect in the far north.

In connection, doubtless, with the circumstance that the Burghs Gas Supply Act is being adopted by the Burntisland Town Council, Mr. J. Falconer, Public Analyst and Gas Examiner of Edinburgh, delivered the last of the weekly popular lectures in that town, the subject chosen being "Coal Gas." The lecture was experimentally illustrated, and was of an exceedingly interesting character. Mr. Wallace, the Town Clerk, who has been much engaged in the negotiations for the acquisition of the gas-works from the North British Railway Company, occupied the chair on the occasion.

The Municipal Authorities of Dundee are at present much taken up with a proposal to have what is known as the "Albo-Carbon Light" publicly tested on a large scale in two of the leading streets of the town. Mr. James Livesey, C.E., London, one of the patentees of the system, has just written a letter to a Dundee newspaper, in which he speaks of the light

as being at once powerful, steady, and agreeable, and more rich and soft than the electric light; while, in point of economy, it will, he believes, bear a still more favourable comparison.

It is stated that one of Otto's gas-engines has been ordered by the Dundee Gas Commissioners to work a Siemens or Gramme machine for producing the electric light in the experiments which are about to be instituted on behalf of that body, and for which a sum of £300 has been voted. Ex-Bailie Maxwell, one of the Commissioners, and Mr. M'Crae, the Manager of the Dundee Gas-Works, have left, or are about to leave for London, in order to witness, and to be able to report upon the illumination of the Thames Embankment, the Holborn Viaduct, the Royal Exchange, and the Mansion House.

On Tuesday last, the Glasgow Gas Corporation Nine per Cent. Annuities were quoted at £202, and on the following day there were buyers offering £206, at which price they stood for the rest of the week. The Six and Three-quarter per Cent. Annuities stood at £150. Business was done in the Edinburgh Gas Company's shares at £42 on Tuesday, and at £42 15s. on Thursday.

During the fortnight ending on the 19th inst., the amount of water sent into Glasgow and the suburbs averaged 37,450,000 gallons per 24 hours. At that date the Mugdock reservoir and the lochs contained 95 days supply of water, and the Gorbals reservoirs 127 days supply. The Water Commissioners Sub-Committee on District Inspection of Meters allege that the system of night inspection now in operation resulted in a saving of 1,374,612 gallons per 24 hours during the month from Oct. 23 to Nov. 20. It is expected that the year's expenses for that system of inspection will be about £3000.

At the Greenock Water Trust meeting, held on Tuesday last, a report from the Superintendent of the Water-Works was submitted, which showed that there were 408 million gallons of water in store in the various reservoirs, equal to 116 days supply for all purposes.

The Glasgow Water Commissioners are just completing the laying of fully 2¼ miles of piping, ranging up to 27 inches in diameter, for the purpose of giving an increased supply of water to the eastern districts and suburbs. It is anticipated that the wants which have of late been felt have been fully met for a considerable number of years.

At two recent meetings of the Edinburgh and Leith Engineers Society, the subjects under consideration have been the Ebbw Vale Water-Works and the works recently constructed at Campbeltown on behalf of the Duke of Argyll.

Last week's Glasgow pig iron market was steady, and a large amount of business was done at higher prices. Business was transacted on Friday afternoon at 43s. 6d. to 43s. 7d. cash, and at the close buyers offered 43s. 6½d., while sellers held out for 43s. 7½d.

There has been an increased demand for house coals during the past week, but otherwise there is no special change to report in the condition of things.

Thirsk Water Supply.—Last Friday, a meeting for the purpose of forming a Company, with limited liability, for the purpose of supplying the town and district of Thirsk with water, was held—Mr. A. C. Bamlett in the chair. Mr. Swarbrick (of the firm of Swarbrick and Rhodes, Thirsk), explained the nature and objects of the scheme, and produced the plans and sections of the proposed works, and an estimate of the cost. He stated that an application had been made to the Board of Trade for a Provisional Order to authorize the construction of the works, and at the conclusion of his remarks the meeting unanimously adopted a resolution to the effect that a Company should be immediately formed, and subsequently Articles of Association were entered into.

Suffocation of a Woman by Gas at Salford.—On the 4th inst. an inquest was held at Salford on the body of a woman, named Mary Ann Lane, who was found insensible in bed, in a house where there was a strong smell of gas, especially on the landings. From the evidence of John Pendleton, the Superintendent of the Corporation Gas-Works, it appeared that an 8-inch main was found to be fractured, and the main sewer which passed under the gas-pipe was charged with gas. He stated that if the drain-pipe of the slop-stone in the deceased's house had been properly closed, the gas could not have got into the premises. The jury returned a verdict that the deceased died from congestion of the brain and lungs, produced by inhaling coal gas; and that she came by her death accidentally.

Explosion at the Newport (Mon.) Gas-Works.—Last Tuesday an explosion occurred in the engine-house of the Newport (Mon.) Gas-Works, which, fortunately, was not attended with any very serious result. None of those engaged about the works were injured, and the damage to property is not expected to exceed £80 or £100. It appears that one of the workmen, about half-past eleven o'clock in the morning, was engaged in cleaning one of the purifiers, when a sudden rush of gas blew off the seal of a pipe which lies beneath the floor of the room. This caused a large quantity of gas to escape, and becoming ignited, an explosion was the result. The comparatively trifling nature of the mishap is entirely due to the promptitude which was displayed by the Manager of the works (Mr. Canning), who was immediately on the spot, and took all the measures of precaution required to prevent the occurrence from assuming a graver aspect.

A Joint Sewage Scheme for Lancashire.—Last Friday, a Conference of Local Authorities, Engineers, and others interested in the economical disposal of water-carried sewage was held at Manchester, at the invitation of Sir Henry Cole, K.C.B., to discuss a proposal for bringing the smaller towns of Lancashire into local federations for the purification of their sewage. The meeting was attended by representatives of a considerable number of districts. Sir Henry Cole pointed out in some detail the advantages of the proposed federal system, the adoption of which was calculated to save at least one-third of the expense of the treatment of sewage. The idea was generally approved of by the other speakers at the conference, but some of them anticipated much difficulty in persuading different localities to adopt combined action as proposed. A resolution commending the principle to the careful consideration of Sanitary Boards was passed, and, on the suggestion of Sir H. Cole, the meeting was adjourned for three months, with a view to practical steps being devised in the meantime.

Dorking Water Supply.—A special meeting of the Dorking Water Company was held on Saturday last, to obtain the sanction of the Shareholders to an application to the Board of Trade for a Provisional Order, authorising the Company to raise £10,000 additional capital, to extend their works, and obtain a new supply of water. The Company's present supply only enables them to provide for a third of the town, and the result of investigations instituted by the Directors and a Committee appointed by the Shareholders, is that a supply can be obtained by gravitation from the hills to the south-west of the town, which, with their present supply, will enable them to provide for the whole town. After some discussion, it was resolved that an application be made to the Board of Trade to confer on the Company power to raise a sum not exceeding £10,000, £8000 by the issue of new shares, and £2000 by mortgage or debentures; to acquire additional land; erect and maintain reservoirs; and construct works for obtaining an additional supply of water, and for storing and distributing it within the limits of the Company's Act.

Deep Boring for Water.—The New River Company have been for some time past sinking a deep well at Turnford, near Cheshunt, in Hertfordshire, in search of the water of the lower greensand. The work has been carried to a depth of 900 feet from the surface, and is now in the gault. The shaft is lined all the way down with a wrought-iron tube, 26 inches in external diameter, so as to exclude the upper waters. Messrs. T. Docwra and Son, who are the contractors for carrying out the undertaking, are now going to continue the exploration, by means of a diamond drill exceeding in size any previously made. The apparatus in question has just been manufactured for the Diamond Drill Company, of Victoria Street, Westminster, according to the patent design of their Engineer, Mr. James K. Gulland. The drill is of steel, in the form of a ring or shallow cylinder, 23 inches in diameter, and 9 inches deep. On its edge are 48 opaque diamonds set in plugs or holders. Although firmly fixed, these admit of easy removal, so as to allow the insertion of fresh diamonds without damage in the removal of the old ones. This species of "iron crown" will be screwed on to the base of the tube forming the lower end of the boring machine, and, when driven by steam power, will be capable of bringing up cores 19½ inches in diameter. The requisite arrangements are being made for keeping the drill cool, by the circulation of water. Much interest attaches to the operations at Turnford, both in relation to the water supply and the proximity of the primary rocks.—*The Times.*

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

5105.—Punshon, R., Brighton, Sussex, "The production of the electric light by means of improved carbon points or candles, and apparatus connected therewith." Dec. 13, 1878.

5110.—Johnson, J. H., Lincoln's Inn Fields, London, "Improvements in regulators for electric light." A communication. Dec. 13, 1878.

5113.—Crossley, F. W., and W. J., Manchester, "Improvements in gas motor engines." Dec. 13, 1878.

5119.—Elleby, C. S., Neath, Glamorgan, "Improvements in appliances to gas-stoves." Dec. 13, 1878.

5123.—Dering, G. E., Lockleys, Herts, "Improved means of obtaining light, heat, and motive power." Dec. 13, 1878.

5139.—Brain, W. B., St. John's Wood, London, "Improvements in apparatus for the production and application of electricity for lighting and other purposes." Dec. 14, 1878.

5141.—Docwra, T., Islington, London, "Improvements in apparatus for undercutting in wells, holes, or borings to be lined." Dec. 14, 1878.

5152.—White, G., Elgin, N.B., "Improvements in electric lamps or lights, and in the electrodes and appliances connected therewith." Dec. 16, 1878.

5153.—Engel, F. H. F., Hamburg, Germany, "Improvements in tube tongs." A communication. Dec. 16, 1878.

5165.—Clark, A. M., Chancery Lane, London, "Improvements in electric lamps." A communication. Dec. 16, 1878.

5169.—Haddan, H. J., Westminster, "Improvements in regulators for gas-burners." A communication. Dec. 17, 1878.

5171.—Waller, G., and Colyer, F., Southwark, London, "Improvements in weir penstocks." Dec. 17, 1878.

5183.—Lake, W. R., Southampton Buildings, London, "Improvements in and relating to electric lighting apparatus." A communication. Dec. 17, 1878.

5189.—Potel, A. P., Rood Lane, London, "Improvements in apparatus for delivering fluids or air." Dec. 18, 1878.

5192.—Reffitt, J., J., and J. W., Leeds, Yorks, "Improvements in swivel joints for pipes." Dec. 18, 1878.

5197.—Wilde, H., Manchester, "Improvements in producing and regulating electric light." Dec. 18, 1878.

5199.—Atkins, F. H. and W. G., Fleet Street, London, "Improvements in filtering apparatus and in filtering materials." Dec. 18, 1878.

5202.—Gibbs, R. R., Liverpool, "Improvements in cocks or valves." Dec. 19, 1878.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

1958.—Newton, H. E., Chancery Lane, London, "Improvements in filtering apparatus." A communication. May 15, 1878.

2376.—Hammond, J., Lewes, Sussex, "An improved method of and apparatus for the complete purification of coal gas by concentrated liquid ammonia, and the recovery of sulphur and ammonia, for the manufacture of sulphuric acid and sulphate of ammonia." June 14, 1878.

2440.—Sugg, W. T., Westminster, "Improvements in counter-balances for gasholders." A communication. June 19, 1878.

2442.—Schütze, F. S., Holborn, London, "Improvements in gas safety-lamps for mines and other places." A communication. June 19, 1878.

2451.—Franzini, M. M., Naples, Italy, "An improved apparatus for lighting purposes." June 20, 1878.

2489.—Redwood, T., Lower Clapton, London, "Improvements in the manufacture of gas for burning." June 22, 1878.

2533.—Shedlock, J. J., Notting Hill, London, "Improvements in the manufacture and purification of gas, and in apparatus connected therewith." June 25, 1878.

2780.—Melling, T., Aigburth, Lancs, "Improvements in and relating to apparatus for reducing or regulating fluid pressure, and for measuring and registering the pressures and quantities of water or other fluid flowing in given times through pipes or other conduits." July 11, 1878.

3837.—Longsdon, A., Queen Victoria Street, London, "Improvements in electric light apparatus." A communication. Sept. 28, 1878.

3867.—Emanuel, P., Hamburg, Germany, "An improved pipe vice." Oct. 1, 1878.

3976.—Ward, M. R., Brighton, Sussex, "Improvements in magneto-electric machines, or machines for generating electricity." Oct. 9, 1878.

3988.—Fox, St. G. L., Telegraph Street, London, "Improvements in obtaining light by electricity, and in conveying, distributing, measuring, and regulating the electric current for the same, and in the means or apparatus employed therein." Oct. 9, 1878.

3991.—Clark, J., Kensington, London, "A new or improved method of adapting the electric light to domestic and other ordinary purposes." Oct. 9, 1878.

3994.—Hopper, G. C., Southampton Buildings, London, "Improvements in wrenches." A communication. Oct. 9, 1878.

4043.—Fox, St. G. L., Telegraph Street, London, "Improvements in the application of electricity to lighting and heating purposes, and in the means or apparatus employed therein." Oct. 12, 1878.

4074.—Arnaud, A., Blackfriars Road, London, "A mode of indefinitely dividing electric currents." Oct. 14, 1878.

4100.—Varley, F. H., Newington Green Road, London, "Improved means of producing electricity and the electric light." Oct. 15, 1878.

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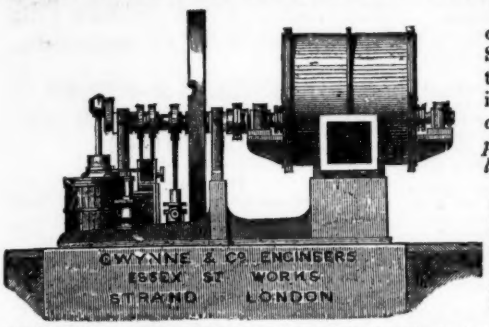

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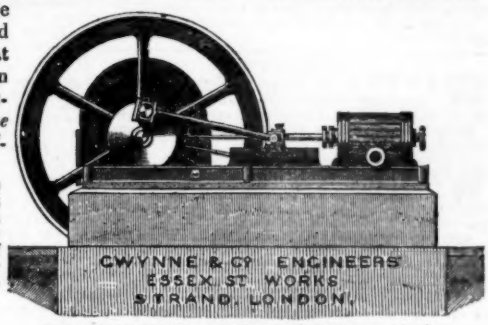

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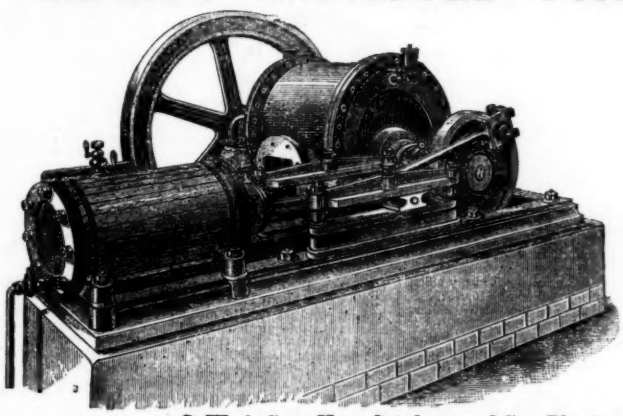

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Gas Offices, Great Yarmouth, Dec. 16, 1878.

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GAS-BURNERS.

See Page 941.

Now ready, Second Edition, price 7s., by post 7s. 3d., the

GAS MANAGER'S HANDBOOK.

By THOMAS NEWBIGGING, M.I.C.E.

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J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

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May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Our R. D., Sen., having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations, is both extensive and reliable.

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effecting a great saving of time, labour, and expense.

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SOLE PROPRIETORS AND MANUFACTURERS OF
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These Paints have been for many years extensively used in Her Majesty's Royal Dockyards, Woolwich Arsenal, the Shorncliffe and Curragh Camps, War Departments, and Colonies, and are largely supplied to Railway, Harbour, and GAS COMPANIES, Shipowners, Engineering Establishments, Railway Carriage and Wagon Works, and the Paint Trade generally. They are the BEST PROTECTORS of WOOD, CEMENT, and IRONWORK, even arresting corrosion after it has set in; and their base being oxide of iron, they are free from those properties which make lead paints so destructive to iron. They do not scale or blister, are not affected by great heat, and are the only Paints which will resist the effects of sulphuretted hydrogen. Their DURABILITY and covering properties have borne the test of A QUARTER OF A CENTURY'S PRACTICAL TRIAL.

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Imperial Stone.	Light Stone.
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A great variety of Colours ready mixed for the brush are also always kept in Stock, in 3 lb., 7 lb., 14 lb., and 28 lb. cans.

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ECONOMY IN THE PRODUCTION OF GAS.
PLUTONIC CEMENT,
FOR JOINTING AND REPAIRING RETORTS AND OVENS *in* ACTION AND *out* OF ACTION.
A Pamphlet on the advantages of the above, with Modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,
WILLIAM RICHARDSON, Gas and Hydraulic Engineer, CHARLES HENRY STREET, and BISSELL STREET, BIRMINGHAM.

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SILBER LIGHT COMPANY, LIMITED,
49, WHITECROSS STREET, LONDON, E.C.,
Manufacturers of SILBER BURNERS FOR COAL OR AIR GAS, & FITTINGS.

No. 285.

The *World* says: "The light given by these Burners, besides being abundant in quantity, is almost like sunlight in its quality, so that it produces the same spectrum when refracted through a prism, and allows even the most delicate shades of colour to be distinguished."

Dr. W. WALLACE, F.R.S.E., F.C.S., says: "It gives the steadiest flame of any Argand yet constructed."—*Vide* Report presented to the Dublin Meeting of the British Association, Aug. 15, 1878, "On the Best Means for the Development of Light from Coal Gas of Different Qualities."

The Silber Tubulated Gas-Burner.

No. 291.

The Silber Tubulated Gas-Burner, with Opal Shade and Cup and Governor attached.

The *London Medical Record* says: "This uniform blending of the air with each part of the flame results in rendering it pure and white, and very considerably lessens the blue colour, which is significant of waste, and which is very plainly visible at the base of all imperfect lights. The creation and the maintenance of this white light—not yellow light—is a proof of perfect combustion.

No. 286.

The Silber Bat's-wing Gas-Burner

The *Sanitary Record* says "Mr. Silber's improvements render it possible to eliminate, as far as is practicable, the sulphuric acid due to the incomplete combustion of impure gas."

The *British Medical Journal* says: "In the whole of Mr. Silber's inventions there is noticeable a complete attention to, and adoption of, natural laws."

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Are also Manufacturers of every description of Lamps for Railways, Ships, Streets, Churches, and Domestic Purposes.

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Public Accountant,
MOORGATE STREET CHAMBERS,
GREAT SWAN ALLEY,
MOORGATE STREET, E.C.

MR. EDWARD SANDELL,
Associate of the Society of Accountants in England,
Publisher of the
"Gas Companies Expenditure Journal,"
Begs to announce his REMOVAL from Skinner's Place, Size Lane, to
No. 2, ST. GEORGE STREET, WESTMINSTER.

CADZOW COAL COMPANY,
LIMITED.
Cadzow Collieries, Hamilton (Lanarkshire).
Office: 161, Hope Street, Glasgow.

Report on the Cadzow Ell Coal.
By Dr. W. WALLACE, F.R.S.E., F.C.S., Gas Examiner for the City of Glasgow.

I have made a careful chemical analysis and practical assay of an average sample of the Ell Coal from Cadzow Colliery, received on the 5th inst., from Messrs. The Cadzow Coal Company, Hamilton, and have obtained the following results:—

Analysis.

Volatile matters	Gas, tar, &c.	34·03	
	Sulphur	·04	46·12
	Water, at 212° Fahr.	12·05	
Coke	Fixed carbon	52·90	
	Sulphur	·03	53·88
	Ash.	·95	
			100·00

Coke (dry) per ton of Coal, 1205 lbs., or 10 cwts. 3 qrs. 1 lb

Analysis of the Coke (Dry).

Carbonaceous or combustible matter	98·18
Sulphur	·06
Ash.	1·76
	100·00

Specific gravity of the coal	1·250
Weight of a cubic foot in pounds	77¾

Practical Results.

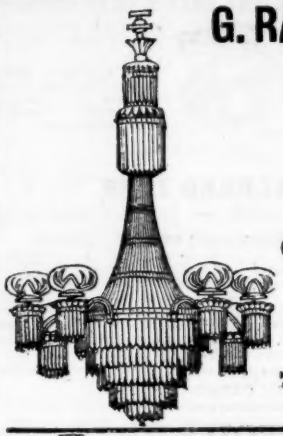
Gas per ton of coal at 60° F. and 30 in. bar.	10,122 cub. ft.
Illuminating power in standard sperm candles by Argand jet, consuming 5 cubic feet per hour	16·76 candles.
Value of one cubic foot of gas in grains of sperm	402
Equivalent of a ton of coal in pounds of sperm candles	581
Durability of one cubic foot of gas by 5-inch flame	42 min. 45 sec.
Gravity of the gas, air = 1000	448

Remarks.

The sample tested consisted of a complete section of the seam, 5 ft. 6 in. in thickness. The results show that this Coal is well adapted for the manufacture of gas and coke, both being for soft coal of very fine quality. Of the many hundreds of coal samples I have tested, I have not hitherto had one with so small a proportion of ash as the Cadzow Coal.

WILLIAM WALLACE.

Chemical and Gas Laboratory,
138, Bath Street, Glasgow, March 15, 1878.



G. RAINSFORD & SON,
ESTABLISHED 1850,
MANUFACTURERS
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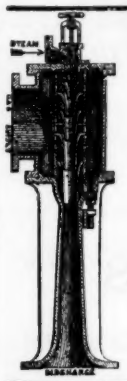
AND
GAS-FITTINGS,
SUITABLE FOR
GAS COMPANIES.
70, BROAD STREET,
BIRMINGHAM.



KÖRTING'S STEAM-JET EXHAUSTER.
IMPROVED CLELAND'S PATENT.
UPWARDS OF 300 IN USE.
CLELAND'S SLOW-SPEED CONDENSER & STEAM SCRUBBER
FOR PARTICULARS, APPLY TO
KÖRTING BROS.,
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OR TO
GERALD J. TUPP, Creek Engine-Works,
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SOLE AGENT FOR ENGLAND AND WALES.

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CAST-IRON PIPES for GAS & WATER.
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THE AMERICAN GAS-LIGHT JOURNAL.
A. M. CALLENDER & CO., Proprietors. **G. WARREN DRESSER, Editor.**
Issued Semi-Monthly at No. 42 Pine Street, New York City.
This Journal is especially devoted to Gas Engineering and Manufacture, and is the official organ of the AMERICAN GAS-LIGHT ASSOCIATION, and the NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
Subscriptions at $3.50 per annum, post paid, to Great Britain, may be made direct by forwarding Post Office Money Order or Draft to the above address. Rates of advertisement, $2.00 an inch. Special rates for larger spaces.

GAS PURIFICATION
BY
OXIDE OF IRON.

COOKE BROTHERS

Beg to draw the attention of Gas Companies to the following certificate, relative to the quantity and quality of their Oxide, from the Assistant Surveyor of the County of Donegal:—

"*Londonderry, Oct.* 12, 1878.

"I have examined some of the deposits of iron ore in the following localities in the county of Donegal, over which Messrs. Cooke Brothers hold exclusive royalties for raising the ore—namely, several townlands in the Barony of Kilmacrenan, including the estate of Viscount Southwell, in the Barony of Raphoe, the estates of Sir Samuel Hayes and Colonel Montgomery, in the Barony of Ennishowen, several townlands on the estate of Mr. Newton—and I certify that the several estates are rich in Oxide; that the ore is of a very good quality, such as is usually shipped from this county; that the districts, which are very extensive, are capable of producing a large supply; in fact, the supply of ore on these estates is practically inexhaustible.

(Signed) "PHILIP M'LAUGHLIN, *Assistant County Surveyor.*"

COOKE BROTHERS beg to state they are also in possession of several other exclusive sources of supply, independent of those included in the above certificate.

26, 27, *and* 28 *Fenchurch Street, London, E.C., Oct.*, 1878.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

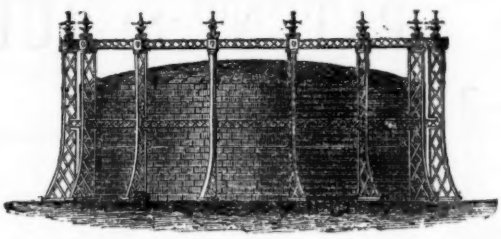
ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS.

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

WESTMINSTER CHAMBERS, VICTORIA STREET,

GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, URIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

MANN & OWENS' PATENT GAS-VALVE.

EVERY VALVE WARRANTED TO BE PERFECTLY SOUND AND GAS-TIGHT.

VALVE, with Indicator or Above Ground. UNDERGROUND VALVE.

The advantages of this Patent Valve over all others yet introduced are, that it is always as tight as the best wedge or spring valve, without the possibility of setting fast or becoming suddenly leaky. The surfaces not being in contact during the operation of opening or closing, leakage through wear and tear is avoided.

The Gas Engineer will not fail to see the importance of such a valve in connexion with his purifying apparatus, particularly in the case of large sizes.

The slide being operated either by a screw and nut, or by a pinion and rack, a cam bearing upon a plane, cast on the back of the Valve, forces it against the face, and renders the escape of gas an impossibility. By a slight turn of the pinion or screw, the slide is released, and brought away from the face, by which means friction is avoided, and the only force required to open the Valve is that due to its own weight.

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Price 1s. 8d. per lb., any size.
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MANUFACTURERS OF

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BUYERS OF COAL TAR,
And Crude Products therefrom,
AMMONIACAL LIQUOR, &c.

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Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Agent in London, Mr. J. MANWARING, 101 Cannon Street, E.C.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Keep in London and at their works large stocks of PIPES and CONNEXIONS (1¼ to 36 inches in diameter); also make and supply Retorts, Tanks, Columns, Girders, Special Castings required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

CHARLES HORSLEY, Agent.

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SILICA FIRE-BRICK CO.,

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Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

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FIRE CLAY & BRICK WORKS,

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Of all Dimensions for Gas-Works,

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Of every kind.

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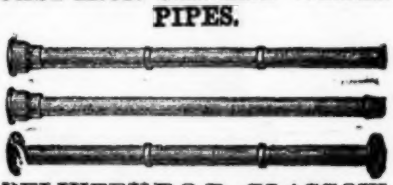
CAST-IRON GAS AND WATER PIPES.



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Prices on application.

C. & W. WALKER,
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MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im-portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

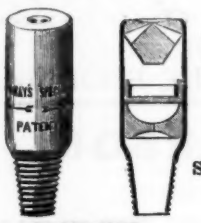
They contain their own engine power, re-quiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

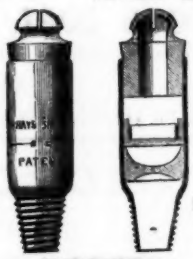
DESCRIPTIVE CATALOGUE
OF
BRAY'S "ENAMEL" GAS-BURNERS.

In presenting this Catalogue, we wish it to be known that we are the only Manufacturers in Great Britain of Non-Corrosive Slit-Union Burners. We make them under Patents taken out here, and in several Foreign countries, of our own material, "Enamel," which is much harder and less brittle than "Steotite" (of which the imported Slit-Unions are made), and, therefore, less liable to fracture. We may also state that our burner factory is the most extensive in the World, and the only one in which composite Non-Corrosive Gas-burners are made *in all their parts*,—facts which give us the power of meeting the various requirements of gas illumination in a way that cannot be accomplished by those who make up burners from parts which are purchased from widely scattered sources.

BRAY'S "SPECIAL"



All these Burners are stamped with Trade Mark as shown in wood cut.



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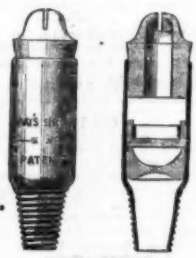


UNION-JET. SLIT-UNION. BAT'S-WING.

We believe our "Special" Burners, as improved, are more adaptable to the requirements of gas illumination than any now before the public. They can be made to suit any pressure or quality of gas (including air gas), give a well-shaped and steady flame, the gas inlet is so placed that it cannot be tampered with, and they are not liable to get out of order.

TWO DISTINCT CLASSES of burners are made, as regards lighting power—viz., for "*Highest Lighting Power*," *and* "*Medium Lighting Power*."

THE HIGHEST LIGHTING POWER CLASS are made to develop the greatest possible amount of light as tested in the Laboratory, and they surpass those supplied by any other maker or dealer, whatever the price charged. When this class is required, it must be distinctly stated so when ordering, at the same time giving quality of gas, and consumption required.

THE MEDIUM LIGHTING POWER CLASS are those which our experience leads us to recommend for general use, in preference to any which yield in the Laboratory the highest lighting power. The latter, whoever they are made by, will always be within, or near, the smoking point, and smoke freely with the slightest atmospheric commotion. To avoid the evils arising from these features, we recommend our medium lighting-power burners, the flames of which are kept well away from the smoking point, and are made to withstand atmospheric commotion better than the other class; and will do good service at a lower pressure, and give, we doubt not, *in general use*, as much light. All our "Special" burners are sent out of "Medium Lighting Power Class," unless otherwise ordered.

THE SIZES OF BURNERS are from No. 0 to 9 inclusive.

FOR SIXTEEN-CANDLE GAS (or 14 to 18 candles), the sizes from No. 4 to 9, inclusive, are those which yield the best results from 4 feet of gas and upwards; the lower numbers are for less consumptions.

FOR TWENTY-CANDLE GAS (or 19 to 22 candles), the sizes from No. 3 to 8, inclusive, yield the best results from 3 feet of gas and upwards; the lower numbers being for less consumptions.

FOR TWENTY-FIVE CANDLE GAS (or 23 to 27 candles), the sizes from No. 4 to 9, inclusive, yield the best results from 2½ feet and upwards. When burners are required for this quality, "for Cannel gas" must be distinctly stated when ordering.

FOR OTHER QUALITIES OF GAS (including air gas), burners are made to order.

PRESSURE. All our "Special" burners are made (unless otherwise ordered) to give a suitable spread of flame at five-tenths pressure, and keep in good shape up to twenty-tenths; but we make to order suitable for any specified pressure up to forty-tenths.

STREET-LAMPS. For this purpose these burners are of exceptional value. Those suitable for consumptions of, say, 3, 4, or 5 feet per hour may be made to consume that quantity at any specified pressure from five-tenths to forty-tenths; therefore, a selection of burners may be had, adapted to the several pressures of a town, by the use of which the consumption in the lamps may be balanced with a nicety not equalled by the ordinary working of governors, with the further great advantage of a reduced consumption, when the light is not required, by the usual reduction of pressure in the street-mains at midnight. In ordering for this purpose, it is necessary to state the quality of gas, the consumption, and the number of burners required for each pressure. Extended particulars on this subject will be supplied on application.

FITTINGS. We make our burners to suit the fittings of any country, but, unless otherwise ordered, they are sent out English taper-screw.

FOR GLOBES, the "Bat's-wings" are not suitable, the "Union-Jets" and the "Slit-Unions" are.

BRAY'S "ENAMEL" REGULATORS.

All these Burners are Stamped "Bray's Patent Enamel Regulator," as shown in wood cut.

All these Burners are Stamped "Bray's Patent Enamel Regulator," as shown in wood cut.

UNION-JET. SLIT-UNION. BAT'S-WING.

THE NAME "Regulator" was given to these burners when introduced eleven years ago, because burners having a medium in their interior for gas to pass through, had then become known as "Regulators." Our Union-Jets and Bat's-wings were originally introduced (and now the Slit-Unions are added) to remove two defects in the common metal burners—corrosion and roaring flames,—and our enterprise has been so far successful that the metal burners have been almost supplanted. A steady well-shaped flame is produced by the combined excellence of the tip and the medium through which the gas has to pass in the interior of the burner.

LIGHTING POWER. Though their lighting power is not equal to the "Specials," nor so much under control, yet they are far superior, in this respect, to the common metal burners, with which they closely correspond in price.

THE SIZES are, in Union-Jets and Slit-Unions, Nos. 0 to 8, in Bat's-wings, Nos. 0 to 10 inclusive.

BRAY'S "ENAMEL" NON-REGULATOR.

These are similar burners in outward appearance to the Regulators, but somewhat less, and are without the interior regulating medium. Though they do not prevent the roaring and flickering, as the regulators do, they are excellent burners at the price charged. Our name is not stamped on these burners.

THE SIZES are, in Union-Jets and Slit-Unions, Nos. 0 to 8, and in Bat's-wings, Nos. 0 to 10 inclusive.

BRAY'S MARKET BURNERS.

These are Bat's-wings of unusually large size, and are admirably adapted for markets, butchers, and any purpose for which an immense flame is essential.

THE SIZES ARE Nos. 19 and 20.

All these burners are stamped "Bray's Market Burner," as shown in wood cut.

The RAT'S-TAIL or ONE-HOLE BURNER.

This burner shoots out a straight jet, like a rat's tail, and is used to some extent in Scotland for illuminating purposes; and there, as elsewhere, for heating, cooking, pipe lighting, and other purposes.

THE SIZES kept in stock are Nos. 0 to 6 inclusive, but any other size is made to order.

Every Description of Gas-Burner not herein mentioned made to order in "Enamel."

GEO. BRAY & CO., BLACKMAN LANE, LEEDS.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

198, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 3 per cent. of ash.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full Analyses on application.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,

CANNEL COAL MERCHANT,

HAYMARKET, EDINBURGH.

Established 1840.

DEAN'S PRIMROSE GAS COALS.

South Metropolitan Gaslight and Coke Company, London, July 12, 1878.

The Owners of the Dean's Primrose Colliery.

Dear Sirs,—I have much pleasure in stating that this Company have regularly used your Coals for more than thirty years, and that in all essential particulars they give the most satisfactory results.

The yield of Gas is from 9700 to 9800 feet per ton, of full 16 candles illuminating power, tested by the London Referees Standard Burner; and the Coke is of very good quality, while the quantity is about 40 bushels to the ton of Coal.

I consider Dean's Primrose Coals to rank amongst the first-class Gas Coals from the Durham Coal-Field.

Yours truly, GEORGE LIVESEY.

These Coals are also used by The Gaslight and Coke Company (London), and other English and Foreign Gas Companies.

Steamers loaded with quick despatch in the River Tyne. Price and other terms on application at the

FITTING OFFICE, NEWCASTLE-ON-TYNE.

HOLMSIDE GAS COALS.

South Metropolitan Gaslight and Coke Company, 589, Old Kent Road, London, S.E., Oct. 9, 1873.

At the request of Mr. Hedley, the owner of the Holmside Colliery, I have much pleasure in stating that, for about ten or twelve years past, this Company has taken at least half of its supply of Newcastle Coal from him. I can, therefore, confidently bear testimony to the good quality of the Holmside Coals, and consider they are equal to the best of the Newcastle Coals, in proof of which I may state that this year we are using those Coals exclusively, that the yield of Gas is from 9700 to 9800 feet per ton, and that the quality of the Gas, without any admixture of Cannel, is over 16 candles, as tested by the officer appointed by the Metropolitan Board of Works, using the London Gas Referees test.

The Coke is of excellent quality, and in quantity amounts to about 40 bushels from a ton of Coal.

The annual consumption of Coal amounts to about 75,000 tons.

GEORGE LIVESEY, Engineer and Secretary.

P.S.—I am at this date, Feb. 15, 1875, still using Holmside Coals as largely as ever, and am quite as well pleased with them as when I gave the above certificate.

GEORGE LIVESEY.

We are this year, 1878, using 80,000 tons of Holmside Coal. GEORGE LIVESEY.

FITTING OFFICE:

Address, 75, QUAYSIDE, NEWCASTLE-ON-TYNE.

M. BREMOND'S NAPHTHALINE PROCESS.

A negotiations respecting M. Brémond's patented process for preventing Deposits of

NAPHTHALINE

in Gas Main and Service Pipes should be addressed to Mr. W. H. BENNETT, 22, Great George Street, WESTMINSTER, S.W., or to M. BREMOND, Gas Engineer, Companiz Madrilena de Alumbrado y Calefaccion por Gas, MADRID, who may be consulted upon all matters connected with the Gas Industry.

FERRAND DAVIES,

148 GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,

AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL,

AND

NEWTON, CHAMBERS, & CO.'S SILKSTONE GAS COALS.

Analyses and Quotations on application.

WILSON CARTER AND PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

Address—CHIEF OFFICES:

TEMPLE BUILDINGS, 50, NEW STREET, BIRMINGHAM.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

35A, GREAT GEORGE STREET

WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Invention

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

J. & J. BRADDOCK,

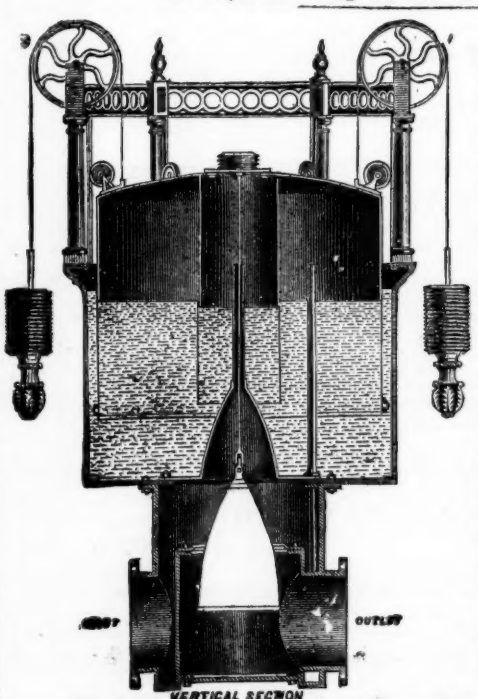
GLOBE METER-WORKS,

OLDHAM,

Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

PARIS EXHIBITION, 1878.

THREE MEDALS

AND

HONOURABLE MENTION

HAVE BEEN AWARDED TO

JOSEPH CLIFF & SONS

For their Various Exhibits, amongst which is a

SILVER MEDAL

FOR THEIR

PATENT MACHINE-MADE

RETORTS AND FIRE-BRICKS,

Being the Highest Honour given for this class.

Established

1795.

JOSEPH CLIFF & SONS,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

London Wharf: No. 4. inside Great Northern Goods Station, King's Cross, N. Liverpool: Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owingto their compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

SAMUEL CUTLER & SONS,

CONTRACTORS FOR GAS & WATER WORKS, GENERAL ENGINEERS, IRONFOUNDERS & MANUFACTURERS OF

GASHOLDERS, TANKS, PURIFIERS,

SCRUBBERS, VALVES, EXHAUSTERS, IRON ROOFS, BRIDGES, BOILERS, AND GENERAL CAST AND WROUGHT IRON WORKS.

S. C. & SONS undertake the entire erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the supplying and laying of MAINS.

They make a speciality of supplying every requisite whatever for Gas-Works, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.

SPECIAL CASTINGS to Drawing or Pattern at Shortest Notice.

Manufacturers of MORRIS & CUTLER'S PATENT CONDENSER & CUTLER'S PATENT GAS-WASHER.

DESCRIPTION OF MORRIS & CUTLER'S PATENT CONDENSER.—The Condenser may consist of pipes arranged in tiers, or in any other form most convenient to the site available, each tier being connected with special connections, and containing within same either one or more coils of smaller pipe through which water is passed, being supplied from any convenient source of supply, the water passing in an opposite direction to the gas, so that the coldest water is at the gas outlet. The power of the Condenser can be regulated precisely in proportion to the quantity of water allowed to pass through, which is not in any way contaminated, but simply heated by the hot gas, and advantage can be taken of its being at a high level to carry it to a high-level cistern, from whence it can be used for supply to boiler or any other purpose. The Condenser itself may form the support for a high-level cistern. By an arrangement of valves the water may be shut off, and an air orifice opened, when air will pass through instead of water, or both air and water can be shut off. The power of the Condenser is, therefore, entirely under control. The Condenser may be seen in operation at the Brentford Gas-Works.

For further Particulars, apply to Mr. F. MORRIS, GAS-WORKS, BRENTFORD, or to S. CUTLER & SONS, PROVIDENCE WORKS, MILLWALL (Near the Steamboat Pier), LONDON, E.

NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

"Warrington Gaslight and Coke Company,
Offices, Mersey Street, Warrington, April 23, 1877.

"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

Full particulars will be sent on application to us—address as above.

NEW PATENT WET GAS-METER,

THE "RELIANCE,"

MANUFACTURED BY THE

GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

The "RELIANCE" METER has been tested by several of the most experienced official meter inspectors. Copies of their reports may be obtained on application to the

GAS-METER COMPANY, LIMITED,

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ALEXANDER WRIGHT & CO.,

MANUFACTURERS OF

"WET" AND "DRY" GAS-METERS,

STATION-METERS, AND GOVERNORS.

METERS, BOXES, REGULATORS, AND ALL REQUISITES FOR PUBLIC LIGHTING.

TESTING APPARATUS for all purposes relating to Gas, &c.

MR. VERNON HARCOURT'S COLOUR TESTS,

Descriptive particulars, per post, 2d.

55, 55a, & 56, MILLBANK STREET, WESTMINSTER, LONDON, S.W.

R. LAIDLAW AND SON,

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Manufacturers of

CONSUMERS IMPROVED WET GAS-METERS,

THE UNVARYING WATER-LINE GAS-METERS,

IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;

STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;

Experimental Meters, Photometers, Pressure-Gauges, Governors, Test Holders, &c., &c.

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IMPROVED HYDRAULIC CRANES,

Effecting a great saving in the cost of discharging Coals from Vessels, Barges, &c. Several of these Cranes, with the necessary power, are now being erected at the Beckton Gas-Works.

DIRECT-ACTING HOISTS

For LIFTING RAILWAY WAGGONS to RETORT-HOUSE STAGEWAY; CAPSTANS for HAULING WAGGONS, &c.,

HYDRAULIC APPARATUS for Lifting and Lowering Purifier-Covers.

Sixteen recently erected at Beckton, applied to Covers 30 feet square.

GAS AND WATER PIPES, ROOFING, BOILERS, &c.

SULPHATE OF AMMONIA APPARATUS,

IN SUCCESSFUL OPERATION AT THE NEW WORKS OF THE NEWCASTLE AND GATESHEAD GAS COMPANY.

For particulars, apply to

JOHN ABBOT & CO., LIMITED,

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London: Printed by WALTER KING, for the Executors of the late WILLIAM BOUGHTON KING (at the office of Clayton and Co., 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, December 24, 1878.